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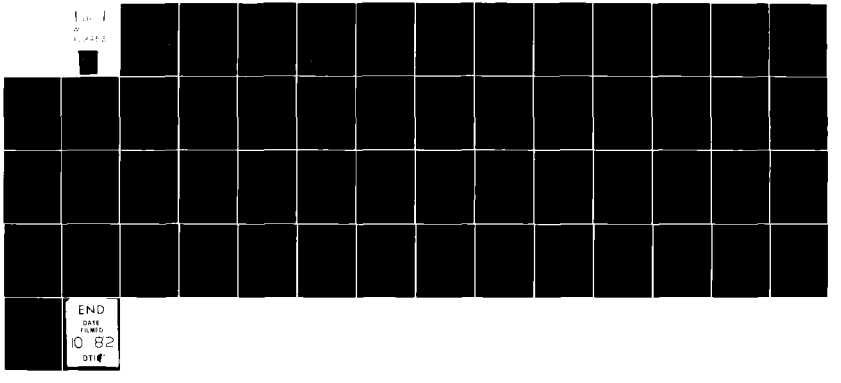

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Beach Profile Analysis System (BPAS)

Volume VII

BPAS User's Guide: Analysis Module ELVDIS

by

Marilyn V. Fleming, Timothy J. Lawler, and Diane French

TECHNICAL REPORT NO. 82-1 (VII)

JUNE 1982

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A package of computer programs for editing, analyzing, and displaying beach profile survey data has been developed. The eight-volume package, named the Beach Profile Analysis System (BPAS), consists of an overview of the BPAS program, two editing programs, five analysis programs, and supporting appendixes.

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The first editing program checks for missing or unreasonable data, surveying or note-reducing errors, and improper arrangement of data cards. The second editing program assumes that most errors have been corrected and, while it does some minor editing, its major function is to sort, reformat, and store the data on the selected permanent storage media. It is also used to update or extract data from existing files and performs some preliminary data analysis.

The analysis programs compute changes in shoreline position, selected contour positions, sand level, sand volume, and statistical trends and correlations. The results are plotted in a number of ways for display purposes. Output can be specified for English or metric units and can be referenced to any horizontal or vertical datum. Contour positions, including the shoreline position, are interpolated linearly between adjacent surveyed points on the profile. If a survey does not cross the datum elevation, but does reach a specified minimum elevation (e.g., +2 feet MSL), the shoreline position can be extrapolated using the two seawardmost points. Before computing volume changes, common bonds are established relative to the landward and seaward extent of the surveys on each profile line. The computed area under each profile is then expressed in terms of a "unit volume" for a shore-normal slice that is one unit wide. Rates of change in shoreline position and unit volume are computed by linear regression analysis.

The BPAS package has been designed for use primarily on the CDC 6600 computer, although much of the coding was done in standard FORTRAN for use on other systems.

PREFACE

This report is published to provide coastal engineers with the documentation of a package of computer programs for editing, analyzing, and displaying beach profile survey data. This package, named the Beach Profile Analysis System (BPAS), was needed for the analysis of a large data bank of field and laboratory profile surveys. The work was carried out under the U.S. Army Coastal Engineering Research Center's (CERC) Beach Profile Studies work unit, Shore Protection and Restoration Program, Coastal Engineering Area of Civil Works Research and Development.

This report (Vol. VII), the seventh of eight volumes, contains user instructions for the analysis module ELVDIS, which produces tables and plots of change and maximum and minimum elevations at specific distances.

The report was prepared by Marilyn V. Fleming, Timothy J. Lawler, and Diane French, Systems Analysts, under the supervision of P. Pierce, Chief, ADP Office, with the assistance of Allan E. DeWall, Geologist, under the supervision of C.J. Galvin, former Chief, Coastal Processes Branch, and Mr. R.P. Savage, Chief, Research Division.

Instrumental insight concerning a previous version of the Beach Profile Analysis System was provided by B. Sims. Programing was accomplished by M. Fleming and T. Lawler with the assistance of D. French, J. Alquist, R. Hylton, and F. Wilson.

The authors acknowledge the helpful discussions and review comments of Drs. C. Everts, C. Galvin, R. Hallermeier, and C. Vincent, and W. Birkemeier, M. Hemsley, A. DeWall, H.C. Miller, B. Sims, and P. Vitale.

Technical Director of CERC was Dr. Robert W. Whalin, P.E., upon publication of this report.

Comments on this publication are invited.

Approved for publication in accordance with Public Law 166, 79th Congress, approved 31 July 1945, as supplemented by Public Law 172, 88th Congress, approved 7 November 1963.

TED E. BISHOP
Colonel, Corps of Engineers
Commander and Director

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CONVERSION FACTORS, U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U.S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	by	To obtain
inches	25.4	millimeters
	2.54	centimeters
square inches	6.452	square centimeters
cubic inches	16.39	cubic centimeters
feet	30.48	centimeters
	0.3048	meters
square feet	0.0929	square meters
cubic feet	0.0283	cubic meters
yards	0.9144	meters
square yards	0.836	square meters
cubic yards	0.7646	cubic meters
miles	1.6093	kilometers
square miles	259.0	hectares
knots	1.852	kilometers per hour
acres	0.4047	hectares
foot-pounds	1.3558	newton meters
millibars	1.0197×10^{-3}	kilograms per square centimeter
ounces	28.35	grams
pounds	453.6	grams
	0.4536	kilograms
ton, long	1.0160	metric tons
ton, short	0.9072	metric tons
degrees (angle)	0.01745	radians
Fahrenheit degrees	5/9	Celsius degrees or Kelvins[1]

[1]To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use formula: $C = (5/9)(F - 32)$.

To obtain Kelvin (K) readings, use formula: $K = (5/9)(F - 32) + 273.15$.

BEACH PROFILE ANALYSIS SYSTEM (BPAS)

Volume VII. BPAS User's Guide: Analysis Module ELVDIS

by

Marilyn V. Fleming, Timothy J. Lawler,

and Diane French

I. INTRODUCTION

This report, the seventh of eight volumes, provides user instructions for processing analysis module ELVDIS, a part of the Beach Profile Analysis System (BPAS) (Fig. 1). The BPAS is a package of computer programs which edit and analyze beach profile data. The objective of the analysis is to compute and display changes in unit volume, shoreline position, and profile geometry. ELVDIS displays beach profile changes, through time, by providing plots and tables of elevation changes at points on profile lines. Included are the elevations at specific points during each survey and profile envelopes, showing the maximum and minimum points for all surveys.

Volumes I and VIII contain information concerning data collection, formatting and restrictions, and program computations, assumptions, and error messages not repeated in this volume. It is recommended that Volumes I and VIII be used in conjunction with this volume. Volume II, which is a user's guide for processing the editing routines, EDIT1 and EDIT2, contains guidelines for the initial preparation of survey data. These guidelines are not repeated in this volume. Other volumes available in the series are:

(a) Volume III, "BPAS User's Guide: Analysis Module SURVY1," which produces comparative plots of beach profiles.

(b) Volume IV, "BPAS User's Guide: Analysis Module SURVY2," which produces plots and tables of contour positions.

(c) Volume V, "BPAS User's Guide: Analysis Module BEACH," which produces plots and tables of unit volume and shoreline position changes.

(d) Volume VI, "BPAS User's Guide: Analysis Module VOLCTR," which produces tables and plots of change in unit volume between specific contour segments.

Each of these volumes contains instructions for processing only the module with which it is concerned.

II. PROGRAM DESCRIPTION

The survey input data processed by program ELVDIS (Fig. 2) are assumed to have already been processed through the editing routines, EDIT1 and EDIT2. These edit routines perform a thorough edit and a partial analysis of the data. The result of this preliminary analysis is contained on the first record in the survey data input file, the header record. The information on the header record, along with information specifying desired outputs and optional data specifications, is used to determine whether the data will exceed the program capabilities. If capabilities will be exceeded or the job has been improperly set up, ELVDIS will print an appropriate error message and stop execution after this initial test. Otherwise, the program will continue.

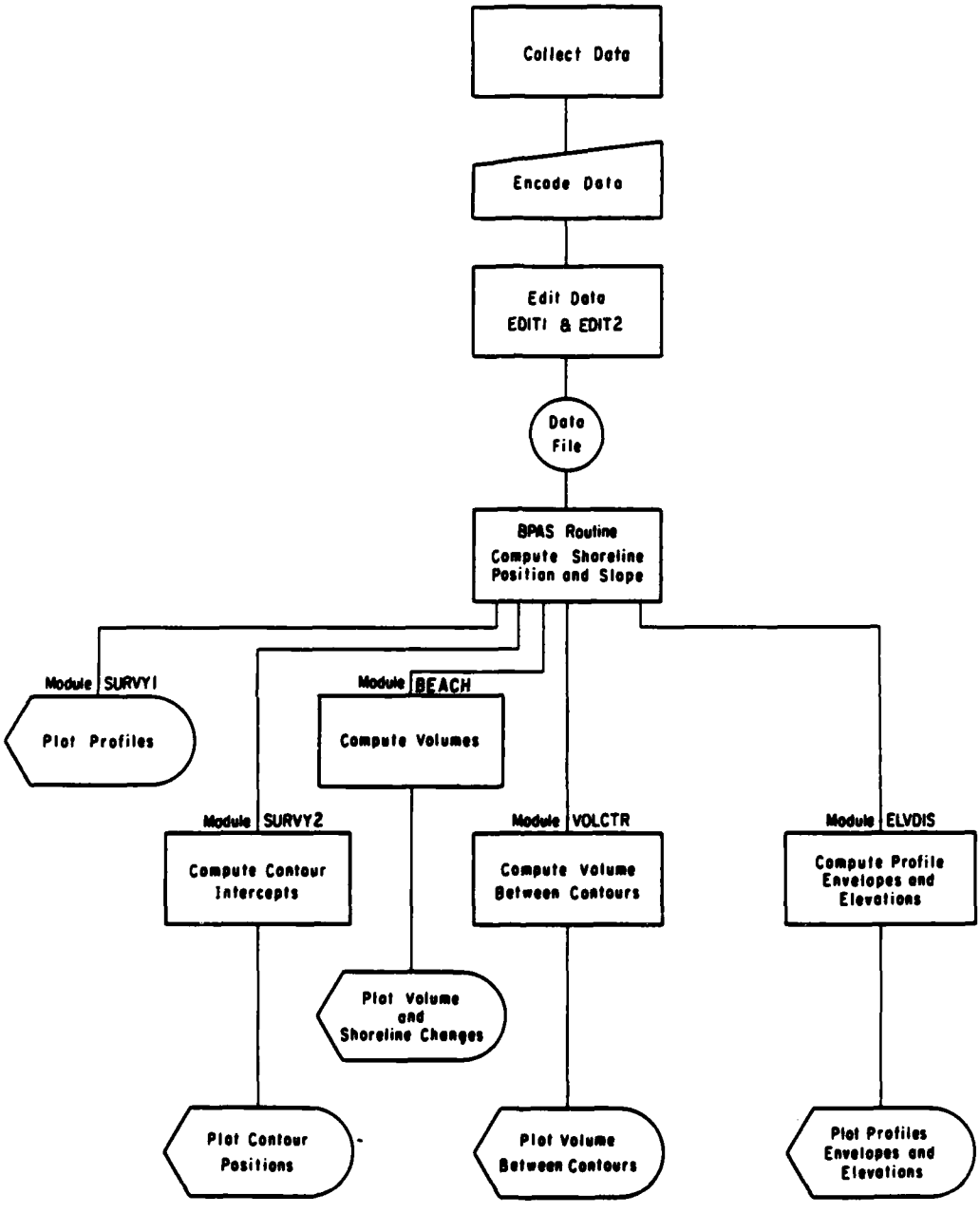


Figure 1. Beach Profile Analysis System.

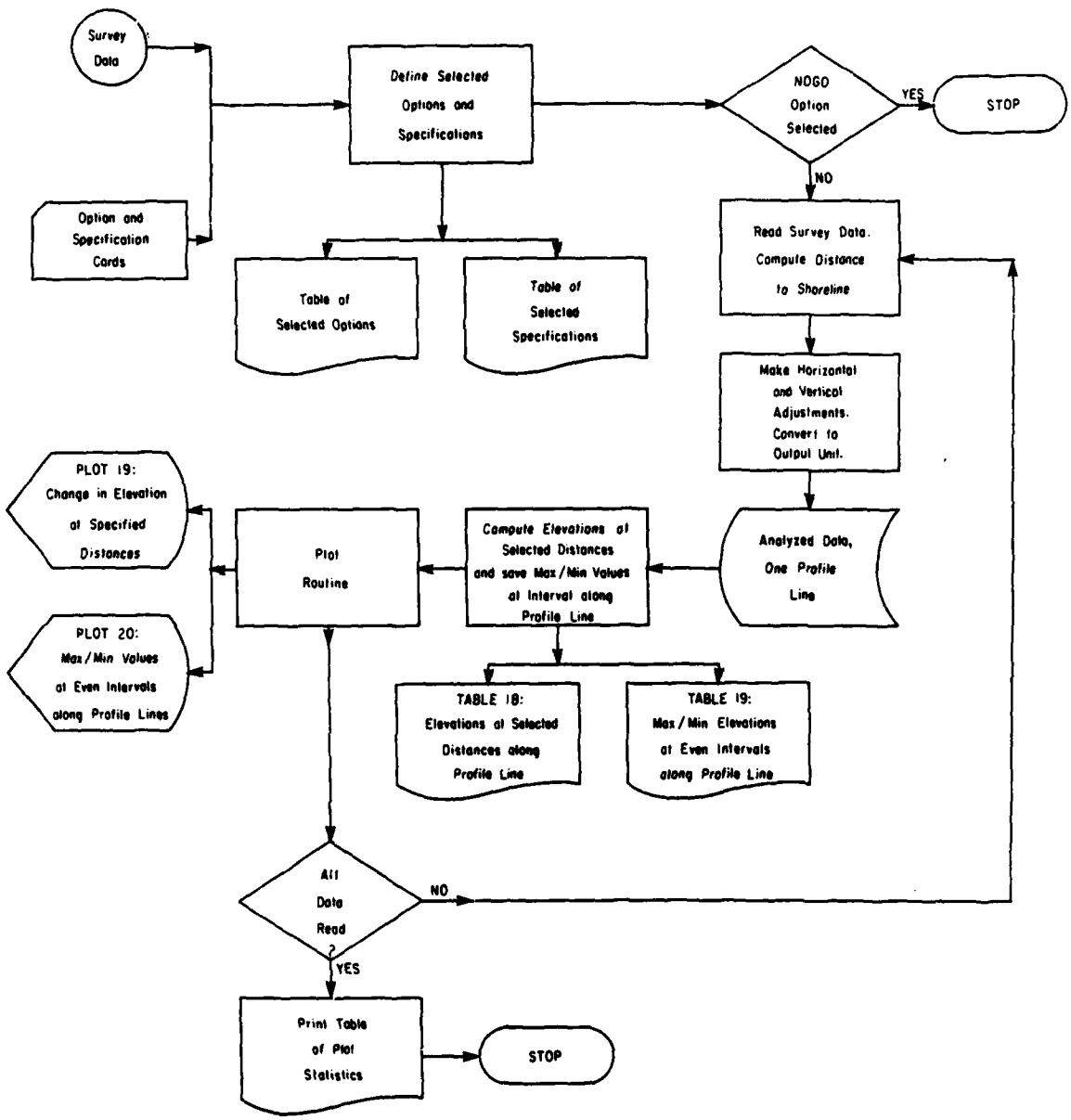


Figure 2. Analysis module ELVDIS.

ELVDIS reads the input data, finds the shoreline position, and produces the requested plots or tables of elevation changes. Records are read until all data for each profile line have been processed. As each record is read, the distance to the shoreline, if defined, is computed. If the shoreline position is not a surveyed point, it is interpolated or optionally extrapolated and inserted in the record. The appropriate adjustments are made to the data to orient the distances and elevations to the specified output horizontal and vertical datums, and the data are converted to the selected output units of measurement. Outputs pertaining to each profile line are written after all data for the profile line have been processed. The program then reads and processes the data for the next profile line. If the output horizontal datum for any profile line cannot be computed (e.g., no shoreline position is defined on the selected reference survey), there will be no output for that profile line except a message informing the user. When all requested outputs have been completed, plot statistics (number of each type of plot produced) are written.

III. HARDWARE AND SOFTWARE REQUIREMENTS

ELVDIS is written in extended FORTRAN IV and was designed to take advantage of processing features available on the Control Data Corporation 6600, Cyber 176 or equivalent computer. Such features include the 10-character, 60-bit word size, the FORTRAN-callable sort routine (interfacing with the NOS or NOS/BE operating system SORTMRG utility), and the utility subroutines and functions DATE, TIME, EOF (to check for end of data file), FLOAT, IFIX, ABS, MOD, and the maximum and minimum functions.

General processing requirements include the 500 series CALCOMP plotting instructions, block data subroutines, ENCODE, DECODE, variable dimensions in subroutines, 132-position line printer, a plotter, and 35,000 (decimal) words of core. Also required are the capabilities to process variable length records of up to 635 characters, to perform unformatted reads and writes, to access up to five unique units for input and output, and to use variable formats and variable input and output units in FORTRAN READ and WRITE statements.

A single run producing all available outputs using the input data listed in Appendix G of Volume VIII, 15 surveys of 12 profile lines, required an average of 47,952 words of core and 70 CPU seconds of processing time. There were 38 pages of output and 38 plots. The job created about 4,469 plot cards. The program is dimensioned to process up to 150 surveys of 100 profile lines, each defined with up to 60 coordinate pairs.

Up to 12 distances may be defined for elevation change plots and tables; the profile envelope will check up to 2,000 points for the maximum and minimum values. Although these dimensions can be modified to process a greater range of data, the procedure for implementing these modifications is beyond the scope of this report.

IV. INPUT DATA

The input data consist of survey records which have been carefully edited and properly formatted by the EDIT1 and EDIT2 programs (see Vol. II). The first record in the survey data file, the header record (Table 1), supplies the range of profile line numbers, survey numbers, and dates. It specifies in

Table 1. Format of the header record.

Position No.	Entry description	FORTRAN format
1-2	00	A2
3-5	Lowest profile line number in data file	I3
6-9	Lowest survey identification number in data file	I4
10-12	Highest profile line number in data file	I3
13-16	Highest survey identification number in data file	I4
17-19	Maximum number coordinate pairs required to define any one survey	I3
20	Number of places to the right of the decimal for distance coordinates	I1
21	Number of places to the right of the decimal for elevation coordinates	I1
22-23	Two-character abbreviation for units of measurement in which data are recorded	A2
24-27	Four-character acronym describing the vertical datum to which data are referenced	A4
28-49	Range of dates, including time, covered by data (yr(I2), mon(I2), d(I2), hr(I3), min(I2))	2(3I2,I3,I2)
50-80	Data description (31 characters)	31A1

what units of measurement the data are recorded, where the decimal should be in the distance and elevation coordinates, and to what vertical datum the data are recorded. This record also contains a 31-character data description. This information is as supplied to or computed by the EDIT2 program. If the information on the header record indicates that the data will exceed any of the program dimensions, an error message is printed and program execution is stopped.

The survey data file, from magnetic media (Table 2) or card images (Table 3), must be sorted by profile line number and then survey number. The module ignores locality codes so all data on a single file should be from the same locality.

V. MODULE OUTPUTS

ELVDIS will produce two tabular and two graphical displays, referred to as TABLE18, TABLE 19, PLOT19, and PLOT20. Any or all of these may be produced during a single run. In addition, tables of selected options and specifications are produced by each run of each analysis module. The plot statistics are produced by the analysis modules when plot output has been requested. A footnote or plot legend, "X EXTRAPOLATED DATUM," will appear only if the user has elected to allow extrapolation of the shoreline position. Sample outputs shown in the following figures have been photo-reduced.

Table 2. Format of final data file--recorded on magnetic media.

Position No.	Entry description	FORTRAN format
1-2	Locality code	A2
3-5	Profile line number	I3
6-9	Survey identification number	I4
10-15	Date of survey	3I2
16-20	Time of survey	I3,I2
21-23	Number of coordinate pairs in the record	I3
24-28	Minimum elevation on the record	I5
29-35	Blank	7X
36-end	Distance and elevation coordinate pairs, five positions per coordinate, no decimal	I5

Table 3. Format of final data file--card image data.

Position No.	Entry description	FORTRAN format
	First card in each record	
1-2	Locality code	A2
3-5	Profile line number	I3
6-9	Survey identification number	I4
10	Card number (1)	A1
11-16	Date of survey	3I2
17-21	Time of survey	I3,I2
22-24	Number of coordinate pairs in the record	I3
25-29	Minimum elevation this record	I5
30-40	Blank	
41-80	First four distance, elevation coordinate, five columns each coordinate, no decimals[1]	8I5
	Second and following cards in each record	
1-9	Same as for first card	
10	Card number (1-9, then A-Z)	A1
11-80	Seven distance, elevation coordinate pairs, five positions each coordinate	14I5

[1]Position of decimal is defined on the header record (see Table 5).

NOTE.--If there are exactly four coordinate pairs (first card only needed, filled to position 80), the second and the last card in the record must be a blank card.

1. Table of Options Selected (Fig. 3).

This table, produced after all option cards have been read by the program, prints the value assigned to each variable which can be defined on an option card. This table should be examined to ensure that the values assigned to these variables are as anticipated.

```
                    O P T I O N S          MAH    RUN  02/18/81  AT  15.42.22.

ANALYSIS MODULE SELECTED-- ELVDIS

USER SELECTED RUN ID-- MAH

LOCALITY DESCRIPTOR IS TEST BEACH

EACH SURVEYED LINE WILL BE CALLED A PROFILE

INPUT DISTANCES ARE COMPUTED FROM THE BENCHMARK

INPUT DISTANCES TO FT X 10**-0, ELEVATIONS TO FT X 10**-1

VERTICAL DATUM IS  MSL
A CORRECTION OF       0.000 FT WILL BE MADE TO EACH VERTICAL CO-ORDINATE.

TIME WILL APPEAR ON OUTPUT. 24-HOUR SYSTEM WILL BE USED.

HORIZONTAL DATUM IS
THE SHORELINE POSITION ON
REFERENCE SURVEY
THERE ARE NO MORE THAN     2 PROFILE LINES.
THE INITIAL SURVEY OF EACH PROFILE LINE WILL BE THE REFERENCE SURVEY.

A CONVERSION FACTOR OF     1.00000 WILL BE USED TO GO FROM INPUT UNITS (FT) TO
OUTPUT UNITS (FT)

A CONVERSION FACTOR OF      .03704 WILL BE USED TO GO FROM SQUARE FT TO  YDS/FT

EXTRAPOLATION WILL BE DONE TO  MSL IF THE LAST SURVEYED POINT REACHES A MINIMUM
ELEVATION OF       2.000 FT


SURVEY INPUT DATA WILL BE READ FROM UNIT  7 IN THIS FORMAT--
(2X,I3,I4,3I2,I3,I2,I3,F5.0,7X,12OF5.0)
```

Figure 3. Sample ELVDIS output--table of options selected.

2. Table of Specifications Selected (Fig. 4).

This table is produced after all special processing and output selection specifications have been read by the program. Anticipated processing specifications and outputs should be compared with those actually selected.

3. TABLE18 (Fig. 5).

TABLE 18 displays elevations at selected distances during each survey of each profile line. Data for up to 12 distances may be displayed. There will be at least one page of output for each profile line in the data set.

```
 SPECIFICATIONS SELECTED FOR ANALYSIS MODULE ELVDIS          MAH     RUN  02/27/81  AT  12.05.59.

TABLE 18 WILL NOT BE OUTPUT.
TABLE 19 WILL NOT BE OUTPUT.
TIME MEASURED AND DISPLAYED IN   DAYS
MAX AND MIN VALUES WILL BE FOUND STARTING AT     0.00 FT FROM BENCHMARK  AND AT EVERY     1.00 FT
MAX AND MIN WILL BE FOUND FOR  ALL DATA
DISTANCES TO BE PLOTTED ON PLOT 19 (FT FROM HORIZONTAL OUTPUT DATUM) ARE---
 150.00,  100.00,   50.00,    0.00,  -50.00, -100.00, -150.00, -200.00, -250.00, -300.00, -350.00, -400.00,

                    PLOT 19   PLOT 20

HORIZONTAL AXIS
  MINIMUM            0.00    -250.00
  INCREMENT         90.00      50.00
  LENGTH             8.10       8.00

VERTICAL AXIS
  MINIMUM           30.00      -5.00
  INCREMENT         -5.00       5.00
  LENGTH             7.00       6.00

OFFSET               0.00       0.00

LINES PER PLOT       1.00       1.00

OVERLAP                NO         NO

FACTORING             YES        YES

PLOT COMMANDS WILL BE WRITTEN ON UNIT  3
```

Figure 4. Sample ELVDIS output--table of processing and output specifications selected.

MAM RUN 02/18/81 AT 15.42.22. PAGE 1

ELEVATIONS (FT ABOVE MSL) AT SPECIFIED DISTANCES ALONG PROFILE LINE 1
AT TEST BEACH
6JAN75/1000 = 15DEC76/0900

HORIZONTAL DATUM IS
THE SHORELINE POSITION ON
6JAN75/1000

DISTANCE (FT)	150.00	100.00	50.00	0.00	-50.00	-100.00	-150.00	-200.00	-250.00	-300.00	-350.00	-400.00
6JAN75/1000				0.00	5.53	10.85	24.33					
3MAR75/1100				.46	5.39	11.18	24.43					
28APR75/1100				1.78	7.55	10.75	24.43					
2JUN75/1100				2.91	6.88	10.65	24.33					
2JUL75/1000				3.51	8.20	11.19	24.43					
9SEP75/1500			-1.20	4.65	9.61	11.28	24.43					
28OCT75/0700		-1.97	-.39	2.40	8.80	11.16	24.43					
25NOV75/1100			-2.01	3.98	8.60	11.67	24.49					
5JAN76/1100			-1.92	3.62	8.02	11.60	24.50					
11MAR76/0800			-1.67	1.96	6.56	11.39	24.74					
6APR76/1400			-1.71	3.12	7.24	11.55	24.72					
8JUN76/1300			-2.40	2.49	7.18	11.22	24.83					
7JUL76/1200			-2.11	3.17	7.29	11.48	24.42					
27SEP76/0900				2.50	8.02	11.40	24.39					
15DEC76/0900			-2.03	1.16	4.96	11.51	24.94					

Figure 5. Sample ELVDIS output--elevations at selected distances, TABLE18.

4. TABLE19 (Fig. 6).

This table shows the maximum and minimum elevations at fixed distances along a profile line, yearly or for all data. There will be at least one page of output for each profile line in the data set; more if the option to compute yearly maximums and minimums is selected.

5. PLOT19 (Fig. 7).

This plot displays changes in elevation at fixed distances along a profile line. Data at up to 12 distances may be displayed on a single plot. There will be one plot for each profile line in the data set unless time of survey, the horizontal axis, is expressed in months. In this case, a new plot will be drawn for each year.

6. PLOT20 (Fig. 8).

This plot shows the maximum and minimum elevations at fixed distances along a profile line. The user can select the starting distance and interval for the maximum and minimum computations. The maximums and minimums may be computed for all surveys at each profile line, in which case there will be one plot for each profile line in the data set or for surveys during each year. Data for one profile line only can be displayed on each plot.

7. PLOT Statistics (Fig. 9).

At the end of each run for which PLOT19 or PLOT20 output was requested, there is a printed table of the number of sets of axes drawn for each type of plot. This information may be used to determine how many plots to expect.

VI. JOB STRUCTURE

The job structure for each of the analysis modules is the same (Fig. 10). The only required system separators are those following the system job control cards and signaling the end of the job. The Appendix contains record layouts for each of the option, processing, and output specification cards used by module ELVDIS. If the option and processing specification cards are absent, the module assigns default values. The output specification cards are required only to identify which outputs are desired; there is a default set of specifications for each ELVDIS output. The format and defaults for the output specification cards are described in paragraphs 3, 4, and 5 of this section. Note that the option and specification cards must be followed by a blank card to signal the end of the cards to be read.

The following contains formats for the records needed to run the module. It is recommended that data be right-justified; i.e., the rightmost character or number always occupies the rightmost position in the field. This will ensure that extra zeros are not added to the end of numeric entries when they are read by the module.

MAH RUN 02/18/81 AT 15.42.22. PAGE 1

MAXIMUM AND MINIMUM ELEVATIONS (FT ABOVE MSL) AT SPECIFIED DISTANCES ALONG PROFILE LINE 1
AT TEST BEACH
6JAN75/1000 - 15DEC76/0900

HORIZONTAL DATUM IS
THE SHORELINE POSITION ON
6JAN75/1000

DISTANCE (FT)	MAXIMUM ELEVATION	DATE/TIME	MINIMUM ELEVATION	DATE/TIME
-178.29	14.40	25NOV75/1100	14.20	6JAN75/1000
-168.29	18.32	15DEC76/0900	17.40	25NOV75/1100
-158.29	22.24	15DEC76/0900	20.92	25NOV75/1100
-148.29	25.00	7JUL76/1200	24.14	6JAN75/1000
-138.29	20.81	8JUN76/1300	19.13	28APR75/1100
-128.29	16.90	8JUN76/1300	15.50	15DEC76/0900
-118.29	14.50	7JUL76/1200	13.00	8JUN76/1300
-108.29	12.70	7JUL76/1200	11.69	2JUN75/1100
-98.29	11.50	25NOV75/1100	10.47	2JUN75/1100
-88.29	10.92	6APR76/1400	9.28	6JAN75/1000
-78.29	10.50	9SEP75/1500	8.80	6JAN75/1000
-68.29	10.50	28OCT75/0700	7.26	3MAR75/1100
-58.29	10.19	9SEP75/1500	6.04	15DEC76/0900
-48.29	9.25	9SEP75/1500	4.78	15DEC76/0900
-38.29	8.10	25NOV75/1100	3.74	15DEC76/0900
-28.29	7.60	25NOV75/1100	2.70	15DEC76/0900
-18.29	6.68	9SEP75/1500	2.05	6JAN75/1000
-8.29	5.57	9SEP75/1500	.94	6JAN75/1000
1.71	4.46	9SEP75/1500	-.19	6JAN75/1000
11.71	3.31	9SEP75/1500	-1.32	6JAN75/1000
21.71	2.10	9SEP75/1500	-2.00	3MAR75/1100
31.71	.93	9SEP75/1500	-1.88	8JUN76/1300
41.71	-.22	28OCT75/0700	-2.16	8JUN76/1300
51.71	-.41	28OCT75/0700	-2.44	8JUN76/1300
61.71	-.56	28OCT75/0700	-2.86	7JUL76/1200
71.71	-.85	28OCT75/0700	-3.50	7JUL76/1200
81.71	-1.22	28OCT75/0700	-1.22	28OCT75/0700
91.71	-1.63	28OCT75/0700	-1.63	28OCT75/0700

Figure 6. Sample ELVDIS output--maximum and minimum elevations at fixed distances, TABLE19.

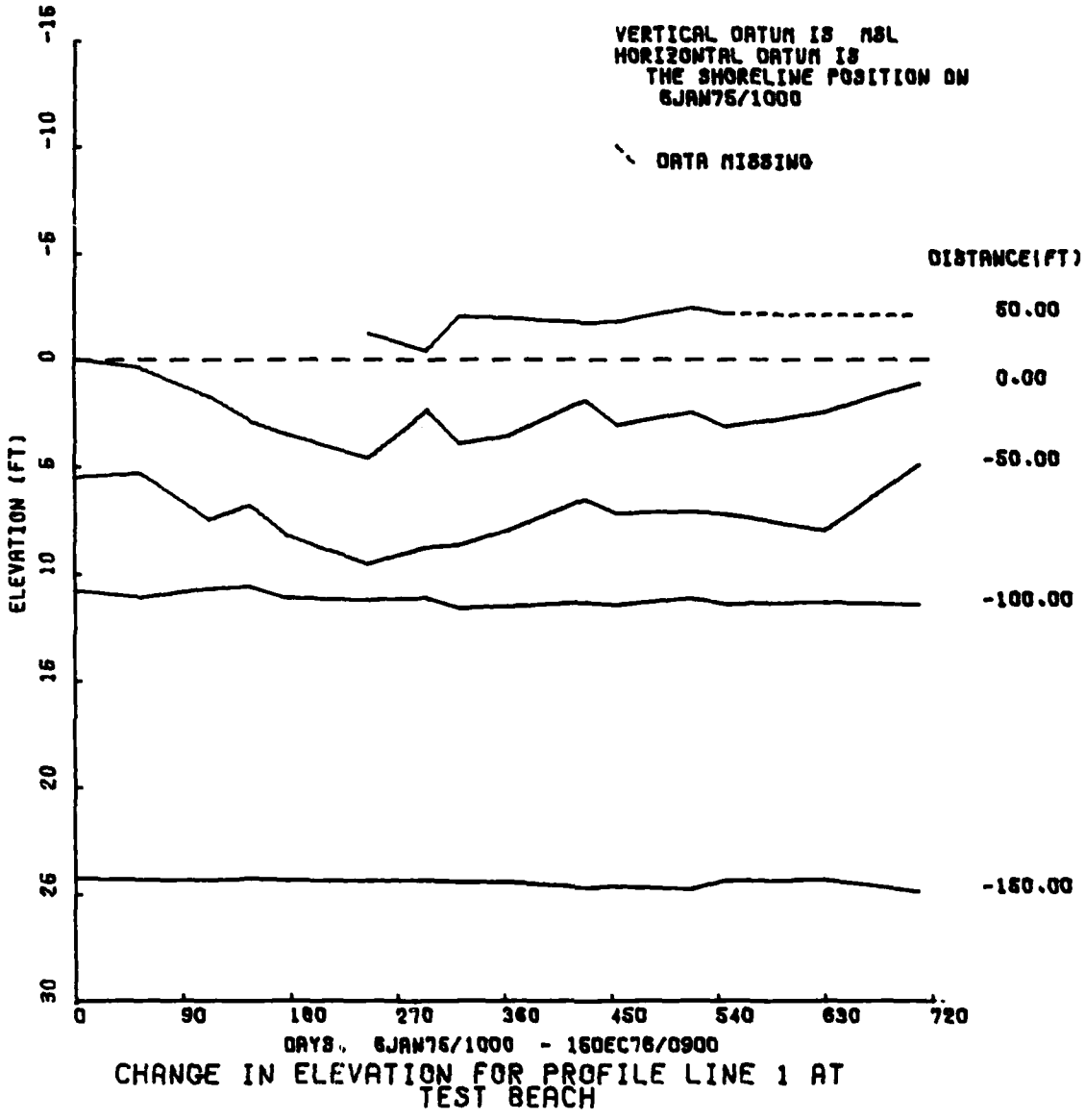


Figure 7. Sample ELVDIS output--change in elevation at specific distances, PLOT19.

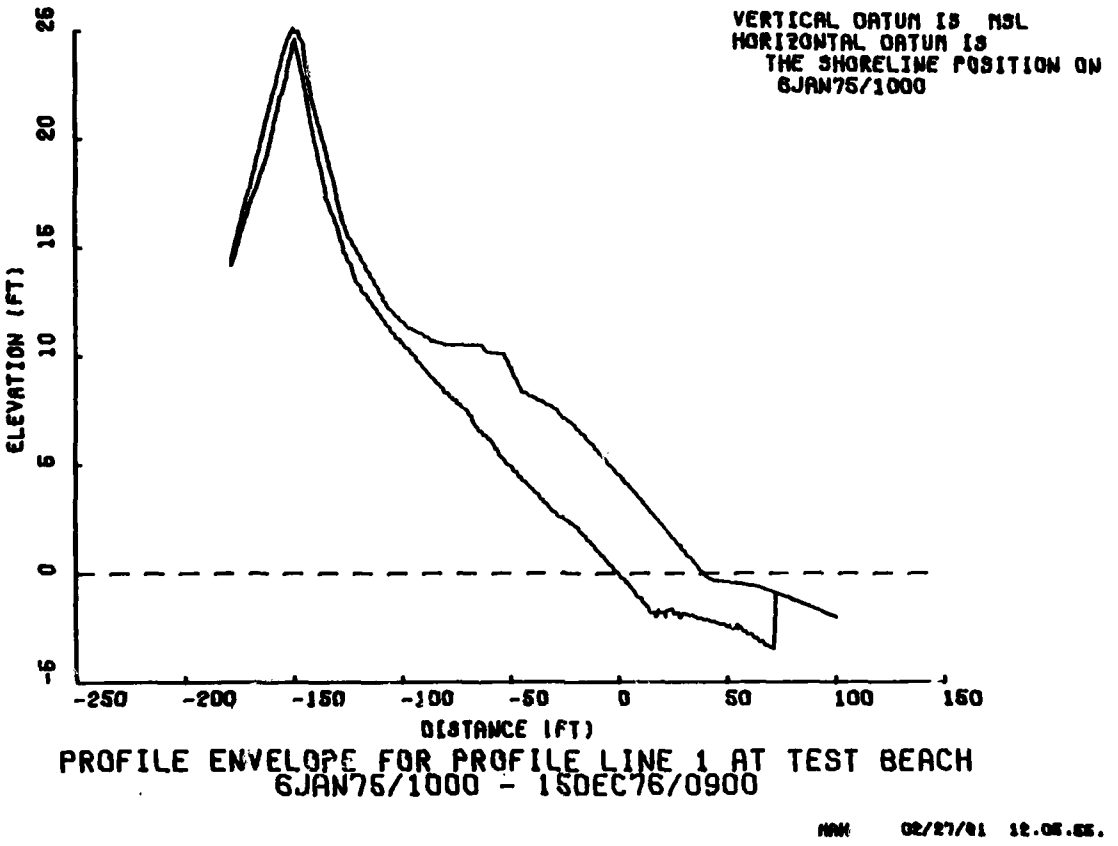
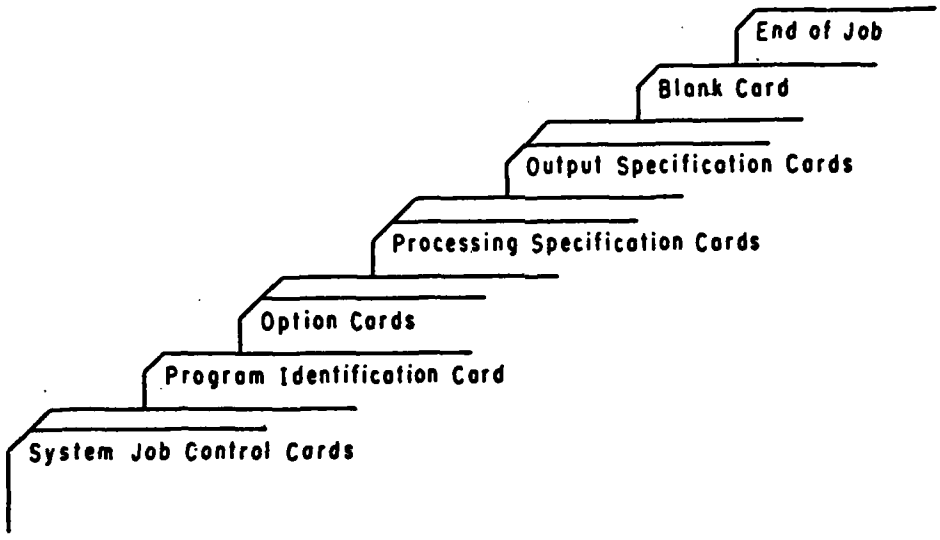


Figure 8. Sample ELVDIS output--maximum and minimum elevations at a profile line, PLOT20.

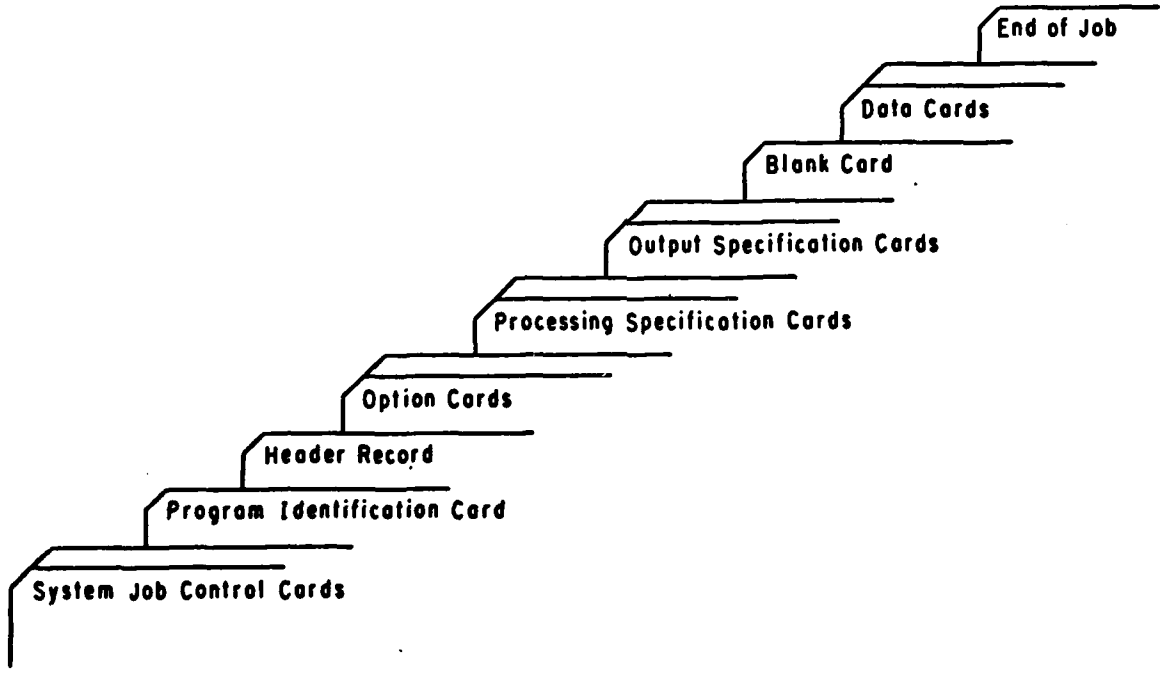
THIS RUN GENERATED THE FOLLOWING GRAPHIC OUTPUT.

PLOT TYPE	NUMBER OF PLOTS
19	2
20	2

Figure 9. Sample ELVDIS output--table of plot statistics.



(1) Data on magnetic media. (Survey data file not read from same unit as options and specifications.)



(2) Data on cards or card images. (Survey data file will be read from the same unit as the options and specifications.)

Figure 10. Job structure.

1. Program Identification Card.

The program identification card (Table 4) is mandatory. It allows the user to assign a name to each run, defines which analysis module is to be processed, and provides the option to halt execution after the table of selected options and processing specifications has been printed.

Table 4. Program identification card.

Position No.	Entry description	Default value	FORTRAN format
1-6	Run identification, usually initials of individual submitting job.	None	A6
8-13	Name of analysis module to be processed. This entry is *mandatory*. Enter "ELVDIS."	None	A6
15-16	Unit from which survey data will be read. Enter a "5" in position 16 if data are to be read from cards or card images.	7 (magnetic media)	I2
77-80	Enter "NOGO" to halt execution after printing of options and specifications, otherwise leave blank.	Run will be executed	A4

It is recommended that a printout of selected options and specifications, with further execution suppressed, be the first run for each analysis attempted. To do this, prepare the job and submit it with NOGO in positions 77 to 80 of the program identification card. The printed options (Fig. 3) and specifications (Fig. 4) should be carefully examined to be sure they match those requested. When satisfied that the desired options, specifications, and selected outputs are correct, resubmit the job with positions 77 to 80 blank.

2. The Header Record.

The header record (Table 1) follows the program identification card when data are read from cards or card images. If survey data are read in magnetic media format, the header record is not a part of the deck setup. See Section IV if more information concerning the header record is desired.

3. The Option Cards.

The option cards make it possible for the user to change some of the data characteristics, processing procedures, and output specifications assumed by the programs. None of the option cards are required. Table 5 contains the values assigned when option cards are omitted. If any of the values are to be changed, only the option cards defining the value to be changed need be submitted and only the fields on the card pertaining to that value need be completed. A more detailed description of each option card follows.

Table 5. ELVDIS analysis options and their defaults.

Option card	Option	Default value
OPT CRD 1	Name of input horizontal datum	Bench mark
	Name of line surveyed	Profile
OPT CRD 2	Format of time on outputs	No time appears
OPT CRD 3	Abbreviation for new vertical datum and required vertical correction.	Abbreviation is as read from header record and no correction is made.
OPT CRD 4	Output horizontal datum	Shoreline position during first survey of each profile line.
OPT CRD 7	Description of the data, for use in titles.	As read from the header record
OPT CRD 8	Linear units in which output is to appear.	As read from the header record
	Conversion factor to change input linear units to output linear units.	1.0
OPT CRD 9	Minimum elevation from which extrapolation is considered valid (>0).	No extrapolation is performed.
OPT CRD 10	Format in which the final data file is to be read.	As necessary to read data as formatted in Table 3 if input is on cards, otherwise as in Table 2.

a. Option Card 1--Input Horizontal Datum (Table 6). OPT CRD 1 defines the name of the lines surveyed (e.g., profile, range, transect) and the name of the input horizontal datum (e.g., bench mark, base line). If the card is omitted or the pertinent field left blank, the line will be labeled a PROFILE line and the input horizontal datum will be called the BENCH MARK.

Table 6. Option card 1--input horizontal datum.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"1"	I1
11-17	Enter the seven-character name of surveyed line if other than PROFILE.	A7
19-28	Enter the 10-character name of input horizontal datum if other than BENCH MARK.	A10

b. Option Card 2--Display of Time (Table 7). The date of a survey always appears on outputs, but the time of the survey does not. OPT CRD 2 allows the user to define the type of time, if any, which is to appear on outputs. If

Table 7. Option card 2--display of time.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"2"	I1
11	Enter the code for the type of time to be written on printed outputs: 0 - no time is written 1 - 24-hour clock time 2 - decimal time	I1

NOTE.--Date of survey is always displayed on output.

the card is omitted or blank, only the date will appear. If the time of day (24-hour clock) or the time, hours and hundredths option is selected, both date and time will be written on outputs. If the latter time option is selected, the minutes will be converted to hundredths of an hour and time displayed as a decimal number.

c. Option Card 3--Output Vertical Datum (Table 8). OPT CRD 3 allows the user to change the vertical datum to which the survey data are referenced. If the card is omitted or left blank, the vertical datum will be as defined on the header record and there will be no change to the vertical coordinates. If a change is desired, enter the four-character abbreviation of the new vertical datum and the amount, in selected *output units*, which must be *added* to each vertical coordinate to make the adjustment.

Table 8. Option card 3--output vertical datum.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"3"	I1
11-14	Enter the four-character abbreviation for output vertical datum if other than that on header record.	A4
15-25	Enter the amount, in *output* units, to be *added* to each vertical coordinate.	F10.3

d. Option Card 4--Output Horizontal Datum (Table 9). OPT CRD 4 allows the user to select the reference horizontal datum to which the output is to be adjusted. If this card is omitted or left blank, the shoreline position during the first survey of each profile line is the output horizontal datum.

Table 9. Option card 4--output horizontal datum.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"4"	I1
11-13	Enter the number of profile lines. *Used only when the output horizontal datum is to be user-supplied.* If left blank, the number of profile lines will be as defined on the header record.[1] The program will expect to read an adjustment for the number of lines entered here.	I3
15 (IXDTM)	Enter the type of output horizontal datum selected: 1 or blank - shoreline position during first or defined reference survey of each line. 3 - mean shoreline position. 4 - no adjustment to distance coordinates. 5 - user-supplied. Adjustments entered on SUP 4A cards.	I1
16-19 (IXDTM = 1 only)	Enter the reference survey number. If blank, program uses the first survey of each line which may or may not be the same for all profile lines. All profile lines not surveyed during the selected reference are eliminated from processing.	I4
16-38 (IXDTM = 5 only)	Enter the first line of description of user-supplied horizontal datum.	2A10,A3
39-67 (IXDTM = 5 only)	Enter the second line of description of user-supplied horizontal datum.	2A10,A9

[1]The header record contains the largest and smallest profile line number. If there is not a profile line associated with each number between, this field should not be left blank.

The distance to the shoreline during the first survey at each profile is computed and this amount is *subtracted* from each distance coordinate. Other choices for the output horizontal datum are: (1) the shoreline position during a survey other than the first, (2) the mean shoreline position, (3) the input horizontal datum (e.g., bench mark--in this case the distance coordinates are unaltered), and (4) a user-supplied correction. If the reference is not user-supplied, use the OPT CRD 4, format 1, shown in the Appendix; otherwise, use OPT CRD 4, format 2.

If the correction is supplied, the user must provide SUP 4A (Table 10) cards to define the amount, in output units, which is to be *subtracted* from each distance coordinate at each profile line. The SUP 4A cards must immediately follow OPT CRD 4, be sequentially numbered, and cannot be included if the output horizontal datum adjustment is not user-supplied. While there need not be an entry on the SUP 4A cards for every profile line in the data set, only those represented will be processed by ELVDIS.

The output horizontal datum option has proven to be useful for plotting profiles with horizontal datums well inland of the active beach, or for comparing lines with datums at varying distances from the shoreline. By adjusting the horizontal datum, profiles are effectively "lined up" at the shoreline, dune crest, or other selected reference distance. Care must be taken to ensure that the horizontal datum exists on the reference survey of

Table 10. Supplementary option cards 4A--distance to output horizontal datum, user-supplied.

Position No.	Entry description	FORTRAN format
1-3	"SUP"	A3
5-6	"4A"	A2
7-9	Sequential card number	I3
11-13	Profile line number	I3
14-23	Corresponding adjustment in output units, to be *subtracted* from each distance coordinate	F10.3
24-26	Profile line number	I3
27-36	Corresponding adjustment	F10.3
37-39	Profile line number	I3
40-49	Corresponding adjustment	F10.3
50-52	Profile line number	I3
53-62	Corresponding adjustment	F10.3
63-65	Profile line number	I3
66-75	Corresponding adjustment	F10.3

each profile line. For example, under default conditions the reference survey is the first survey of each profile line and the horizontal datum is the distance to the zero elevation at the time of that survey. If this position is not defined (i.e., the survey did not extend far enough seaward), the profile line is eliminated from the data set and any output from that particular line is suppressed.

Care must also be taken to ensure that subsequent runs of the data file have the same reference. When data are extracted from larger sets or new data are added to existing sets, it is possible that the first survey of a line will change; it is certain that the mean shoreline position will change. Under these circumstances, the user should record the distance to the horizontal datum for the original data set and supply it on SUP 4A card during subsequent runs.

e. Option Card 7--Data Description (Table 11). The description of the data (e.g., locality or site name) contained on the header record will appear on each output. If the user wishes to change this description, OPT CRD 7 may be used. If the card is omitted or left blank, the data description will be as defined on the header record.

f. Option Card 8--Linear Output Units (Table 12). OPT CRD 8 is used to define the linear output units. If the card is omitted or left blank, the linear output units will be the same as the input. If output units are to be meters or centimeters and the input is in feet, the conversion factor is supplied by the program; otherwise, the user must supply the required conversion factor. Each distance and elevation read from the input survey file will be multiplied by this factor.

Table 11. Option card 7--data description.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"7"	I1
11-41	Enter the 31-character data description which supersedes the description on the header record	3A10,A1

Table 12. Option card 8--linear output units.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-9	"CRD"	A3
9	"8"	I1
11-12	Enter the abbreviation for linear output units of measurement. If blank, these will be as defined on the header record.	A2
13-22	Enter the conversion factor. Input units are multiplied by this number to convert to output units. This field may be blank if: (a) Input and output units are the same (factor set to 1). (b) Input units are FT, output units are M (factor set to 0.3048). (c) Input units are FT, output units are CM (factor set to 30.48).	F10.3

g. Option Card 9--Extrapolation to Zero Elevation (Table 13). Since the shoreline position is of major interest in the analysis of beach profile data, there may be cases when the user decides that extrapolating the distance to the zero elevation is valid. In this case, OPT CRD 9 can be used to specify the elevation, in output units relative to the output vertical datum, that the last surveyed point must reach before the shoreline position can be extrapolated. If the card is omitted or left blank, no extrapolation occurs. When any computation is performed using data for which the shoreline position was extrapolated, output of the results of that computation is flagged. No extrapolation will be performed for profiles where the last line segment is not sloping seaward.

h. Option Card 10--Format of Input Data (Table 14). If the format specified for card image data (Table 3) or magnetic media data (Table 2) does not fit the format of the user's input data, an alternate format may be specified using OPT CRD 10. Knowledge of FORTRAN format specifications is required to use this option effectively. All the data elements but the locality code are used in the analysis computations. Thus, while this card

Table 13. Option card 9--extrapolation to zero elevation.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"9"	I1
11-20	Enter the maximum elevation above the output vertical datum, in output units, which the last surveyed point must reach in order that the shoreline position (datum intercept) be extrapolated. If this is blank or zero, the shoreline position will not be extrapolated.	F10.3

Table 14. Option card 10--format of input data.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
8-9	"10"	I2
11-80	Enter the survey data format. If this card is blank or omitted, data will read as follows: (a) Input unit is 5 (2X,I3,I4,1X, 3I2, I3,I2,F5.0,11X,8F5.0/(10X,13F5.0)). (b) Input unit is 7 (2X,I3,I4,3I2, I3, I2,I3,F5.0,7X,120F5.0).	7A10

can be used to change the field length, order or format in which data elements are read, all elements must be present. The expected order of the variables is shown in Tables 2 and 3; the order in which the variables are read may be changed by using the FORTRAN tab or T format specification. The T format specification is described in most FORTRAN texts and reference manuals, e.g., Stuart (1970)[1].

4. Processing Specification Cards.

These cards are used to define special physical characteristics or processing requirements of the data. When they are omitted, the program assumes that the data conform to certain specifications and assigns default values based on these assumptions. Table 15 shows the processing specifications available for the processing of program ELVDIS and the default values assigned to them. When processing specification cards used for other analysis modules are included in the ELVDIS setup, they are ignored and there is no effect on processing. A more detailed description of each specification follows.

[1] Stuart, F., *FORTRAN Programming*, John Wiley & Sons, Inc., 1970.

Table 15. ELVDIS processing specifications and their defaults.

Specification	Entry description	Default value No.	Default value Distance[1]
DISELEV	Defines distances at which elevations are to be computed during each survey of a profile line.	1	150
		2	100
		3	50
		4	0
		5	-50
		6	-100
		7	-150
		8	-200
		9	-250
		10	-300
		11	-350
		12	-400
ENVLOP	Selects beginning distance[2] for maximum and minimum elevation computations.	0	
	Selects interval for maximum and minimum computations.	Every whole unit	
	Determines whether maximums and minimums are to be found for each year or all data.	All data	

[1]Output units from output horizontal datum.

[2]Output units from input horizontal datum.

a. DISELEV Specification (Table 16). This specification allows the user to select the distances to be analyzed if they differ from the default. There may be no more than 12 distances selected and thus no more than two DISTNCE cards. Each distance is assigned a sequential number when it is entered. All the distances defined on these cards will appear on requested table outputs but the user may select specific ones to appear on plot outputs. The distances should be entered in output units of measurement relative to the output horizontal datum. This specification is useful only for TABLE18 and PLOT19 output.

b. ENVLOP Specification (Table 17). This specification allows the selection of the starting distance for maximum and minimum computations and the interval at which these computations are to be performed. The distances must be in output units of measurement and the starting distance expressed relative to the *input* horizontal datum. This card also allows the user to specify whether the maximums and minimums are to be computed for all data or for each year. If the card is omitted, computations will begin at the input horizontal datum, be performed at every whole unit, and be computed using all data. There are no computations at distances landward or seaward of the surveyed data for any profile. This card is useful only for TABLE19 and PLOT20 output.

5. Output Specification Cards.

ELVDIS will produce two tabular and two graphical displays: TABLE18, TABLE19, PLOT19, and PLOT20. These outputs are described in detail in Section V. With the exception that either all data or yearly data can be used to

Table 16. Format of DISELEV specification card.

Position No.	Entry description	FORTRAN format
1-7	"DISELEV"	A7
9	Sequential card number	I1
11-12	Number of distances (card 1 only; this field must be completed and must correspond to the number of distances to be read).	I2
15-21	Distance No. 1 (card 1); distance No. 8 (card 2) expressed as output units from the output horizontal datum.	F7.2
24-30	Distance No. 2 (card 1) Distance No. 9 (card 2)	F7.2
33-39	Distance No. 3 (card 1) Distance No. 10 (card 2)	F7.2
42-48	Distance No. 4 (card 1) Distance No. 11 (card 2)	F7.2
51-57	Distance No. 5 (card 1) Distance No. 12 (card 2)	F7.2
60-66	Distance No. 6 (card 1)	F7.2
69-75	Distance No. 7 (card 1)	F7.2

Table 17. Format of ENVLOP card.

Position No.	Entry description	FORTRAN format
1-6	"ENVLOP"	A6
11-20	Enter starting distance, output units from *input* horizontal datum, at which maximum and minimum calculations are to begin.	F10.3
21-30	Enter interval at which maximum and minimum calculations are to be performed.	F10.3
31-34	Enter "YEAR" if maximum and minimum calculations are to be for surveys during each year. Leave blank if maximum and minimum calculations are to be for all data.	A4

produce TABLE19 and PLOT20 outputs, any or all of the outputs may be produced during a single run. An output and any required specifications for the output are selected by entering an output specification card. One, and only one, card must be entered for each output selected.

a. Table Output. Table 18 describes the format of the output specification card for ELVDIS TABLE18 (Fig. 5) output. There are no specifications for this table. Table 19 describes the format of the output specification card for TABLE19 output (Fig. 6). On it, the user may specify which of the computed maximum and minimum values is to be printed. This has no effect on those plotted.

Table 18. TABLE18--output specification card.

Position No.	Entry description	FORTRAN format	Default value
1-5	"TABLE"	A5	None
8-9	"18"	I2	None

Table 19. TABLE19--output specification card.

Position No.	Entry description	FORTRAN format	Default value
1-5	"TABLE"	A5	None
8-9	"19"	I2	None
11-15	Enter n. Every nth value will be written on the maximum and minimum table.	I5	10

b. Plot Output. Table 20 describes the format for the output specification card for PLOT19 output (Fig. 7) and defines the defaults which will be assigned if the card is not completed; Table 21 provides the same for PLOT20 output (Fig. 8). A separate card must be prepared for each type of plot to be output. Allow an extra inch on both the horizontal and vertical axes for the plot legend.

(1) Output Unit for Plot Commands. The plot commands may be written either to unit 3 (normally signaling card output) or 8 (normally signaling output to magnetic tape). The user must ensure that data written to these units are handled properly in the job control stream. This entry must match on both plot specification cards. If it does not, the unit used will be that read from the last card encountered.

(2) Default Plot Specification. If the defaults for values supplied in positions 13 to 80 are acceptable and the selected output units of measurement are feet, positions 13 to 80 need not be completed. However, if any plot

Table 20. PLOT19--output specification card.

Position No.	Entry description	FORTRAN format	Default value
1-4	"PLOT"	A7	None
8-9	"19"	I1	None
11	Output unit for plot commands (3, cards; or 8, magnetic tape)	I1	3
12	0 or blank - use defaults (only if output units are feet) 1 - read plot specifications	I1	Use defaults
13	0 - distance 1 to be displayed 1 - distance 1 not to be displayed	I1	0
14	0 - distance 2 to be displayed 1 - distance 2 not to be displayed	I1	0
15	0 - distance 3 to be displayed 1 - distance 3 not to be displayed	I1	0
16	0 - distance 4 to be displayed 1 - distance 4 not to be displayed	I1	0
17	0 - distance 5 to be displayed 1 - distance 5 not to be displayed	I1	0
18	0 - distance 6 to be displayed 1 - distance 6 not to be displayed	I1	0
19	0 - distance 7 to be displayed 1 - distance 7 not to be displayed	I1	0
20	0 - distance 8 to be displayed 1 - distance 8 not to be displayed	I1	0
21	0 - distance 9 to be displayed 1 - distance 9 not to be displayed	I1	0
22	0 - distance 10 to be displayed 1 - distance 10 not to be displayed	I1	0
23	0 - distance 11 to be displayed 1 - distance 11 not to be displayed	I1	0

Table 20. PLOT19--output specification card.--Continued

Position No.	Entry description	FORTRAN format	Default value
24	0 - distance 12 to be displayed 1 - distance 12 not to be displayed	I1	0
25	"H" - time displayed in hours "D" - time displayed in days "M" - time displayed in months (new plot each year) "Y" - time displayed in years Horizontal axis (time): When time is in months, the user has no control over horizontal axis origin, increment, or length. Positions 26 to 42 may be blank. When time is in years, the year should be expressed as 19xx.	A1	Time displayed in months
26-32	origin	F7.2	0.0
33-38	increment (units per inch on plot)	F6.1	2.0
39-42	length in inches	F4.1	6.0
	Vertical axis (elevation):		
43-50	origin	F8.2	-5.0
51-57	increment (units per inch on plot)	F7.2	20.0
58-61	length in inches	F4.1	5.0
63	Enter a "1"		
76	Factoring: "0" - plot size will not be altered "1" - plot size will be altered	I1	No factoring

Table 21. PLOT20--output specification card.

Position No.	Entry description	FORTRAN format	Default value
1-4	"PLOT"	A4	None
8-9	"20"	I2	None
11	Output unit for plot commands: "3" - cards "8" - magnetic tape	I1	3
12	Default specifications: 0 - use defaults (only if output units are feet) "1" - read plot specifications	I1	Use defaults (CC 13-80 not read)
	Horizontal axis (distance):		
13-20	origin	F8.2	-600.0
21-27	increment (units per inch on plot)	F7.2	150.0
28-31	length in inches	F4.1	6.0
33-40	Vertical axis (elevation):		
	origin	F8.2	-10.0
41-47	increment (units per inch on plot)	F7.2	10.0
48-51	length in inches	F4.1	5.0
54	Enter a "1"		
69	Factoring: "0" - plot size not altered "1" - plot size altered	I1	No factoring

specifications are to be supplied or output units are not feet, all fields must be completed. (The unit onto which plot commands are to be written may be changed without affecting other default specifications.)

(3) Distances to be Plotted (PLOT19 Only). The distances of interest are default or as defined on the DISELEV specification card. A sequential number is assigned according to the order in which the distances are defined. By entering a "1" in the appropriate positions 13 to 24 (position 13 corresponding to distance 1, position 14 to distance 2, etc.) the user may specify that a distance *not* be plotted. By leaving the corresponding column blank, or entering a zero, the user indicates that the distance should be plotted.

(4) Horizontal (Time) Axis. Time on the horizontal axis may be expressed as hours, days, months, or years (Fig. 11). If months are chosen, the user has no control over axis origin, increment, or length and a new plot will be drawn for each year represented in the data set. If hours, days, or years are chosen, all data will be plotted on a single plot. Be sure the horizontal axis is defined so that all data will fit. Allow an extra inch for the plot legend.

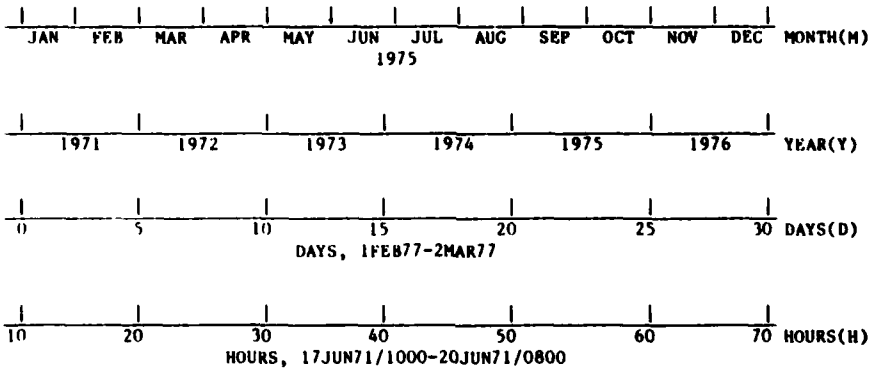


Figure 11. Types of time-elapsed axis available.

(5) Factoring. The factoring option is used to specify whether or not the final plot size is to be altered before being output. The user has no control over the factor used; this is determined by the length of the longer axis. When plots are factored, the x-axis will be no longer than 5 inches and the y-axis no longer than 6 inches. Plot size will be increased if both axes are shorter and decreased if either is longer.

(6) Defining Axis Length, Increment, and Origin. TABLE19 and TABLE20 or the maximum and minimum distance and elevation tabular outputs from program EDIT2 can be used to define optimal axis length, origin, and increment. Allow an extra inch on both the horizontal and vertical axes so that the plot legend will not interfere with the plotted data. When a large number of plots are to be produced, some test plots should be run and examined before the final production run is submitted.

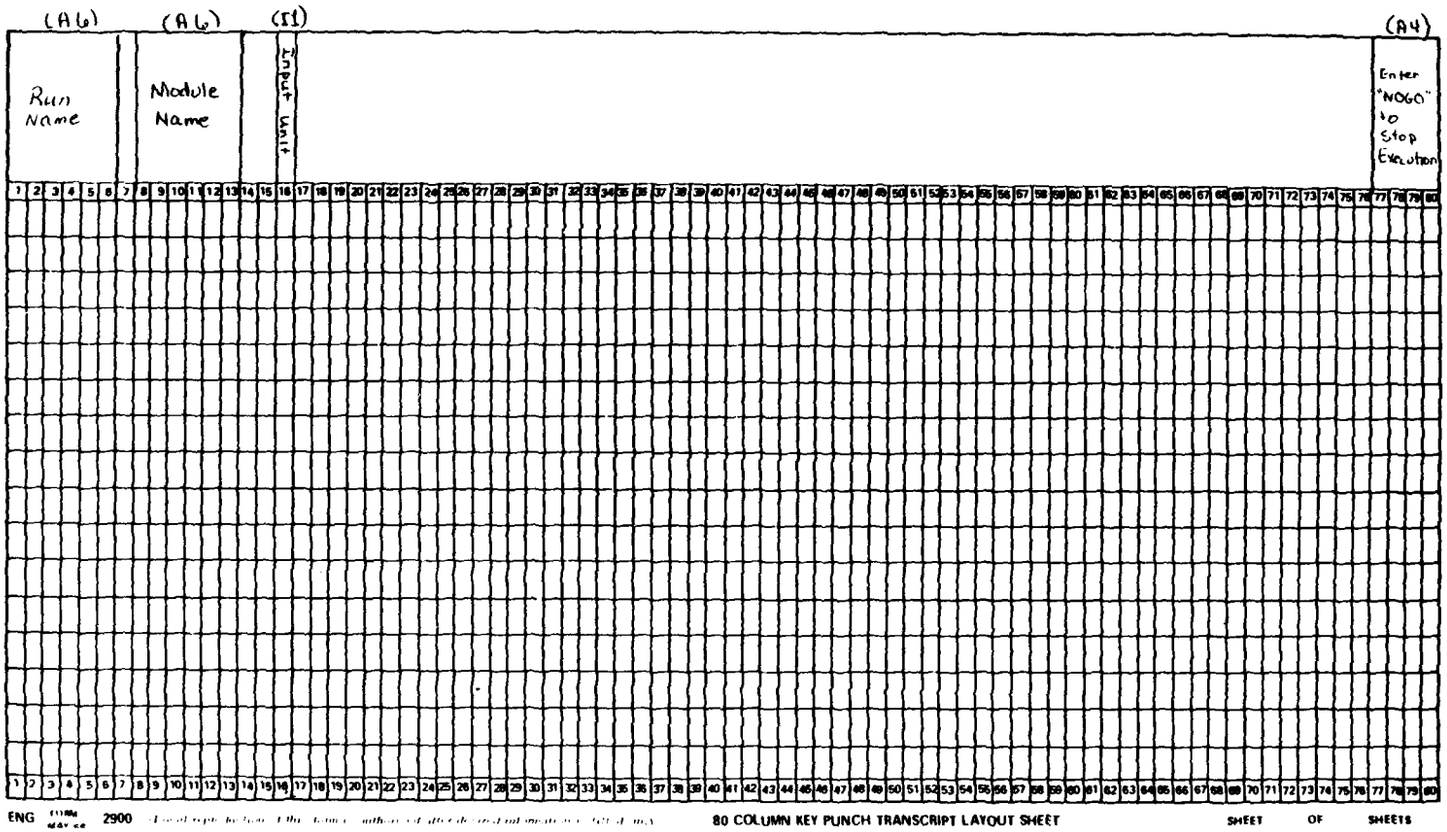
VII. SUMMARY

ELVDIS produces two tabular and two graphical displays. The major function of the module is to display elevation changes and maximums and minimums at specific distances along a profile line. The outputs have been designed so they can be used in reports without being redrafted.

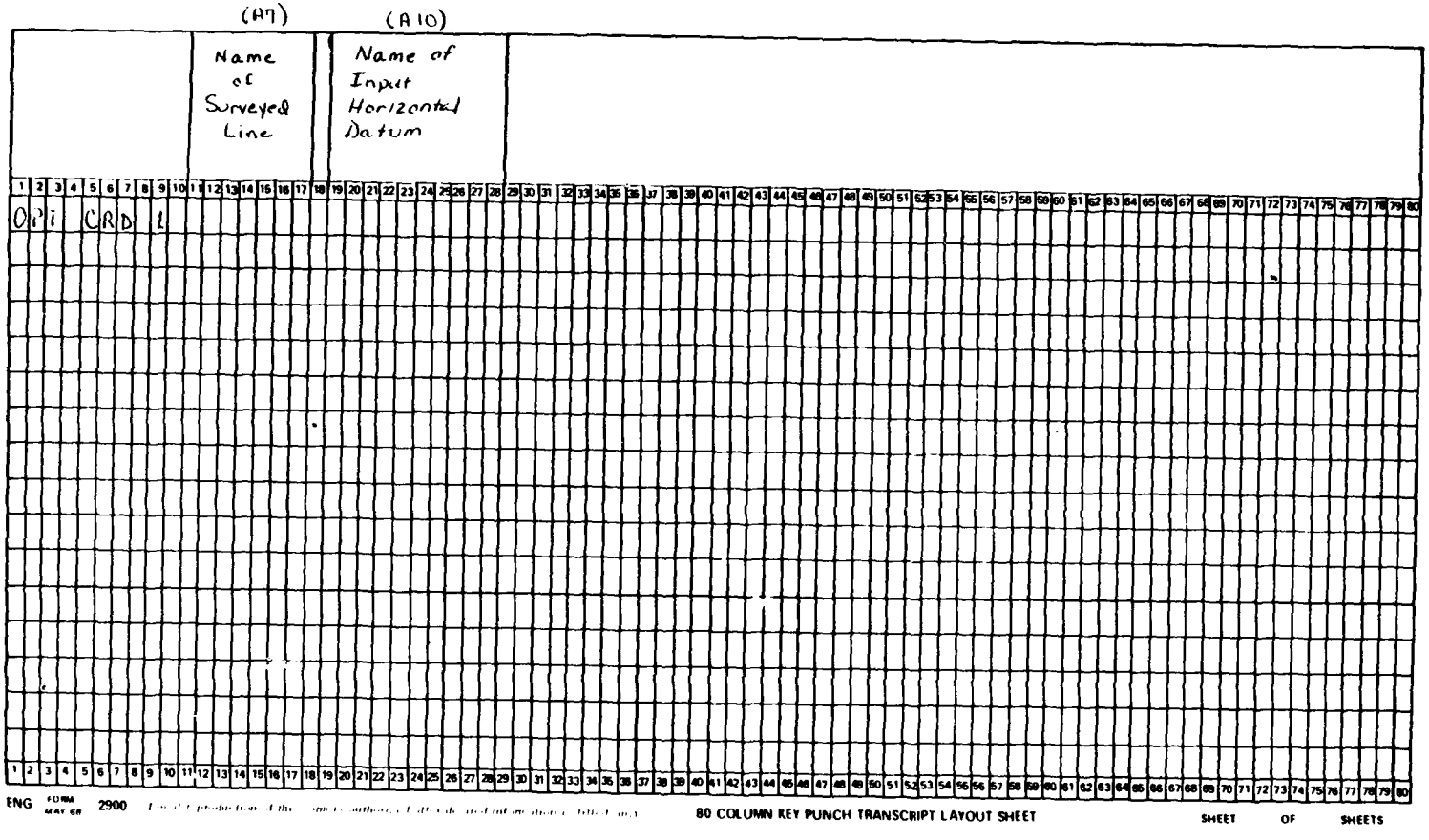
APPENDIX

ELVDIS RECORD LAYOUTS FOR OPTION, PROCESSING, AND OUTPUT SPECIFICATION CARDS

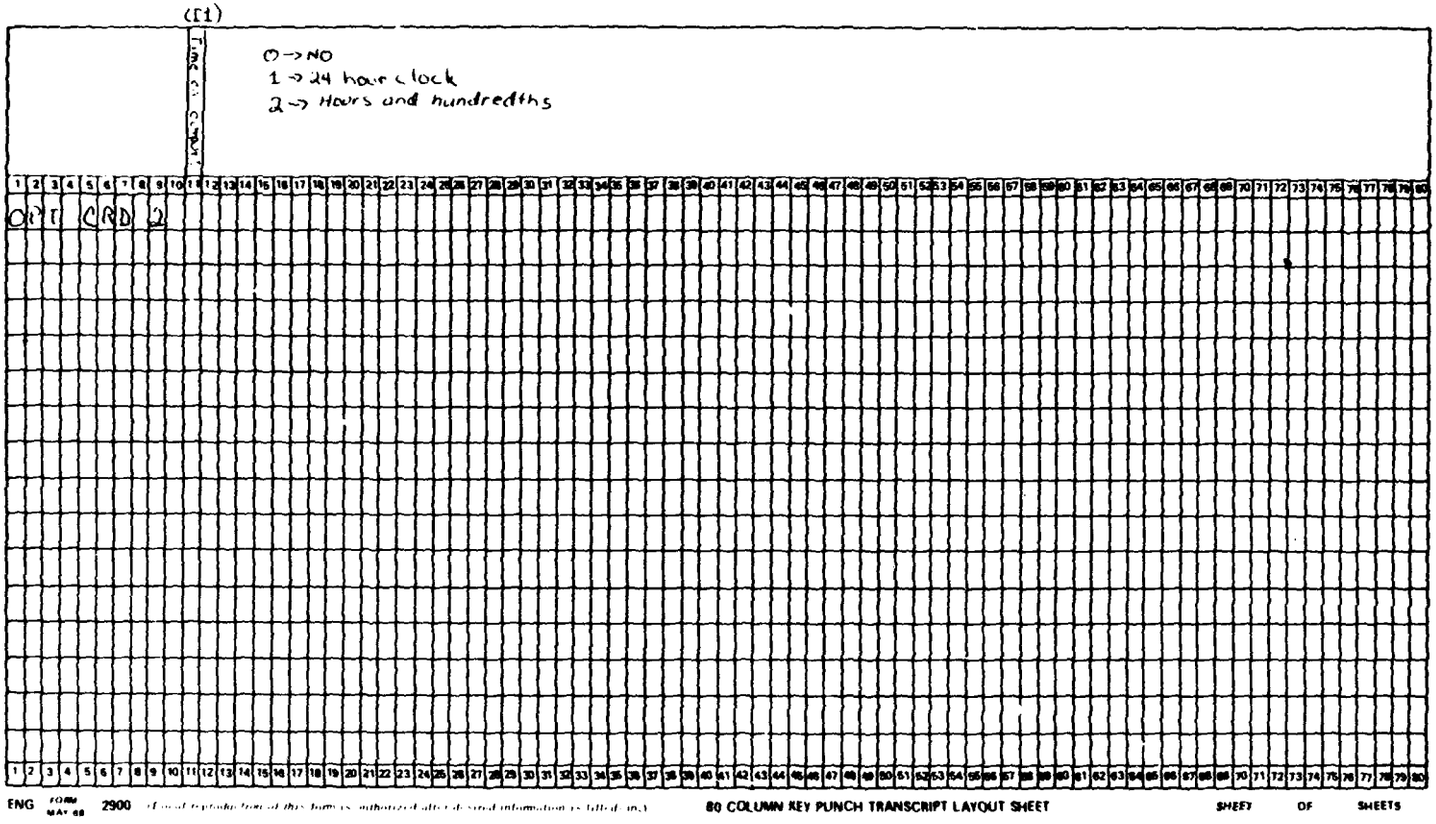
Program ID Card



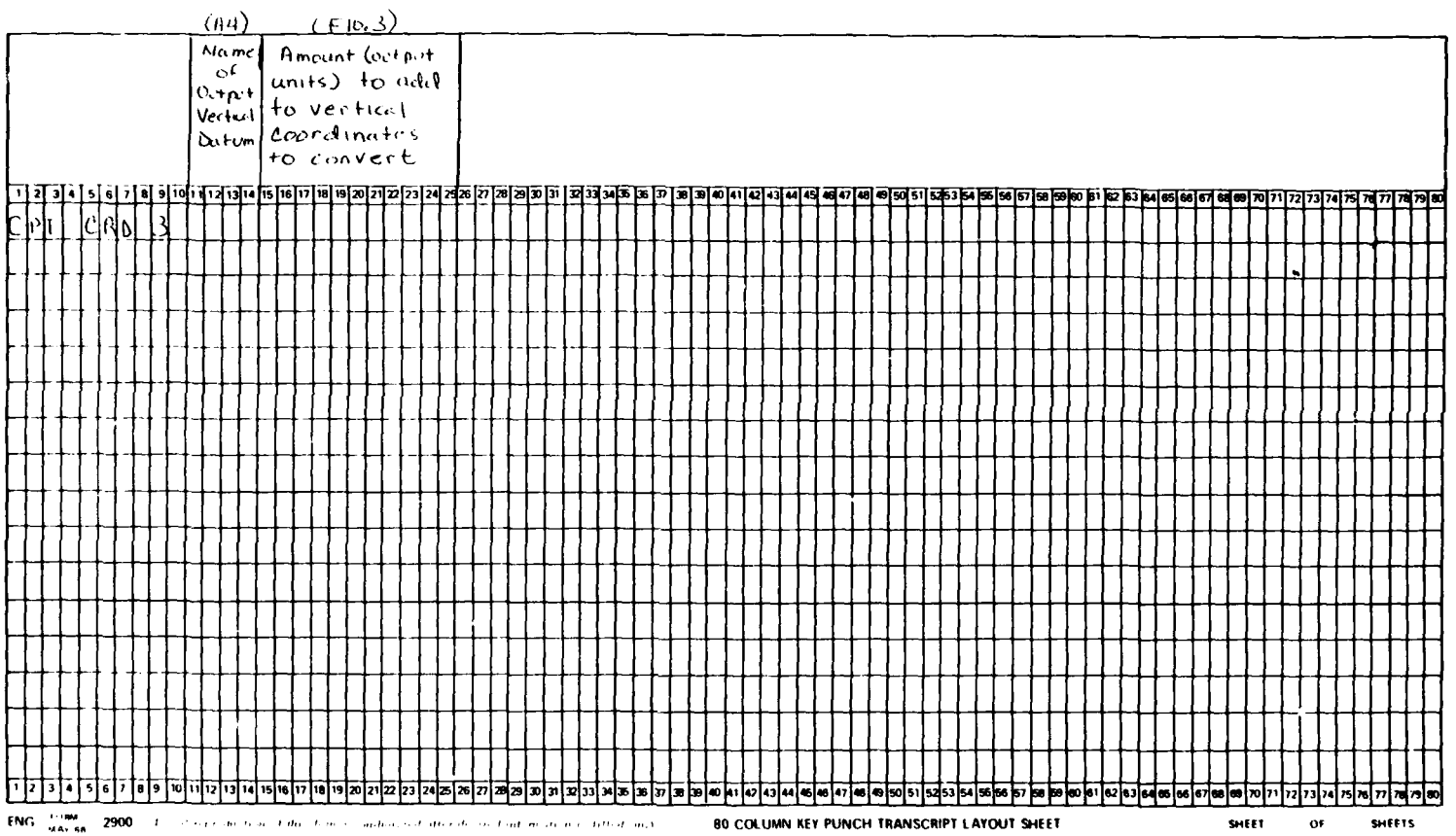
Option Card 1



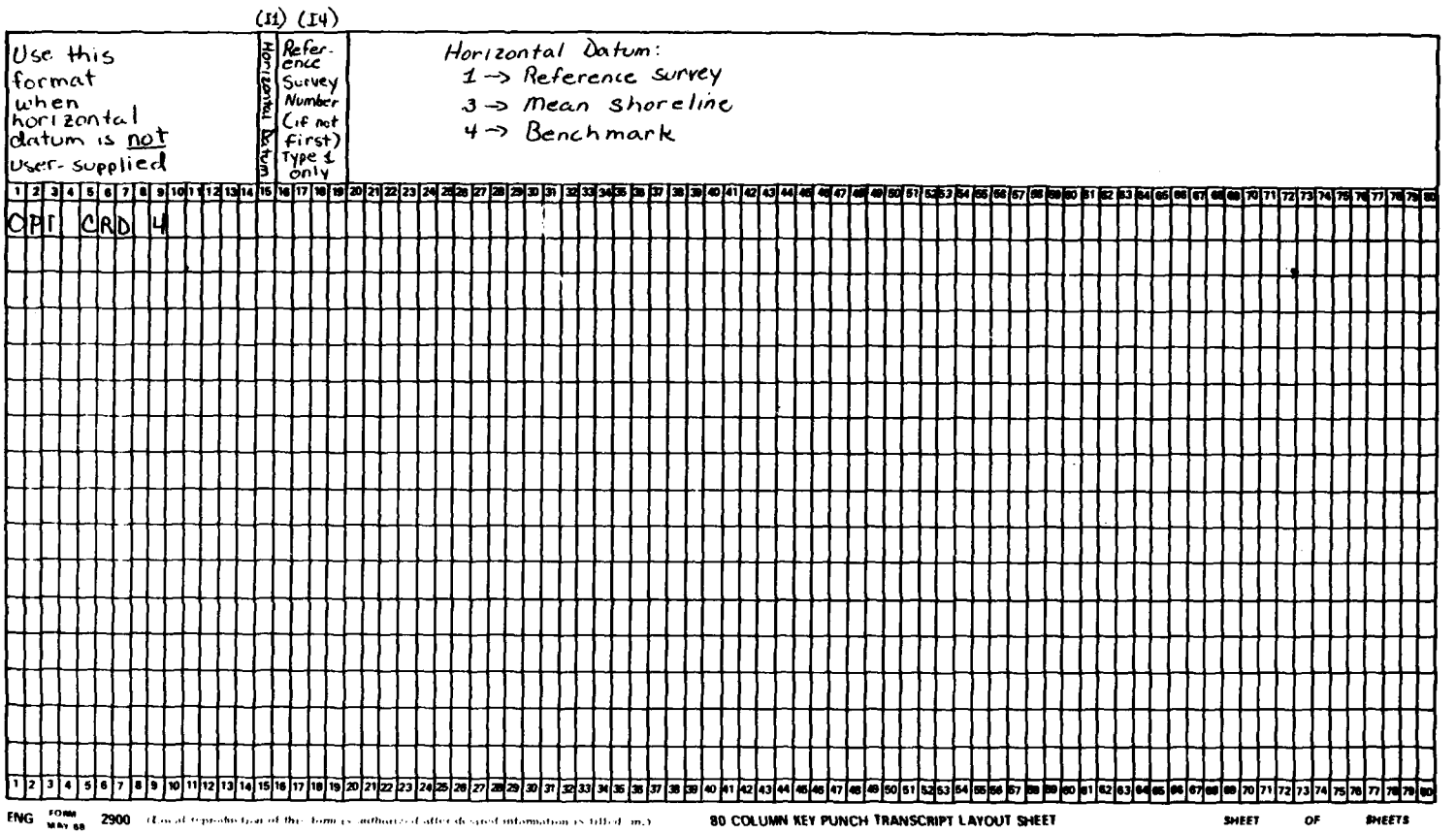
Option Card 2



Option Card 3



Option Card 4, Format 1
(may not be followed by SUP 4A cards)



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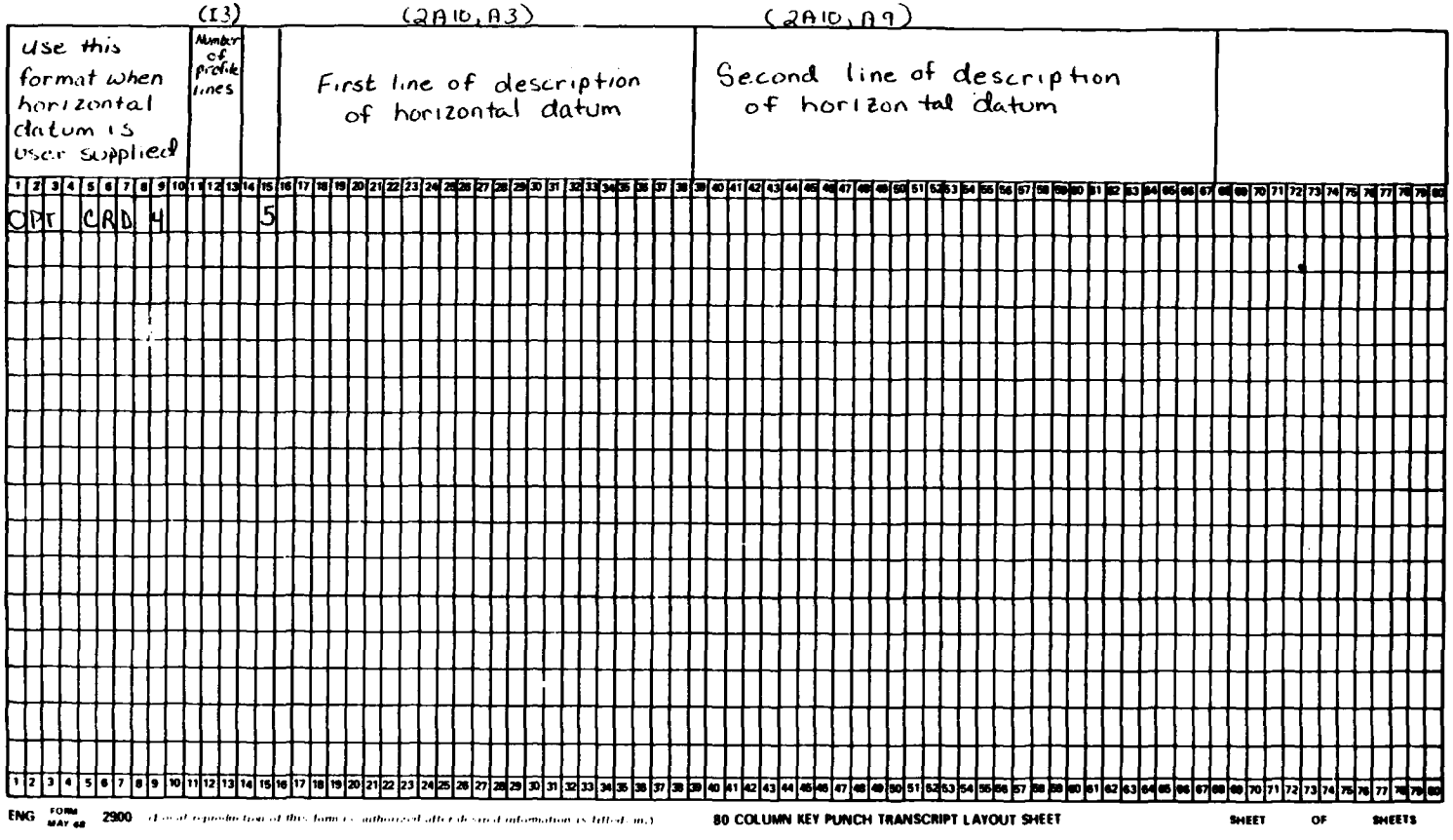
Option Card 4, Format 2
(must be followed by SUP 4A cards)



SUP 4A Cards
(must be preceded by option card 4, Format 2)

Columns 1–6	Columns 7–9 (I3)	Column 10	Columns 11–13 (I3)	Columns 14–23 (F10.3)	Columns 24–26 (I3)	Columns 27–36 (F10.3)	Columns 37–39 (I3)	Columns 40–49 (F10.3)	Columns 50–52 (I3)	Columns 53–62 (F10.3)	Columns 63–65 (I3)	Columns 66–75 (F10.3)	Columns 76–80
Use if and only if type on OPT CRD 4 is 5	Reg. Number		Profile Number	Corresponding Correction (output units to be subtracted from distance coordinates)	Profile Number	Corresponding Correction	Profile Number	Corresponding Correction	Profile Number	Corresponding Correction	Profile Number	Corresponding Correction	
SUP 4A													

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Option Card 7

(3A10,A1)

	31 Character description of data if that on the header record is not acceptable	

OPT CRD 7

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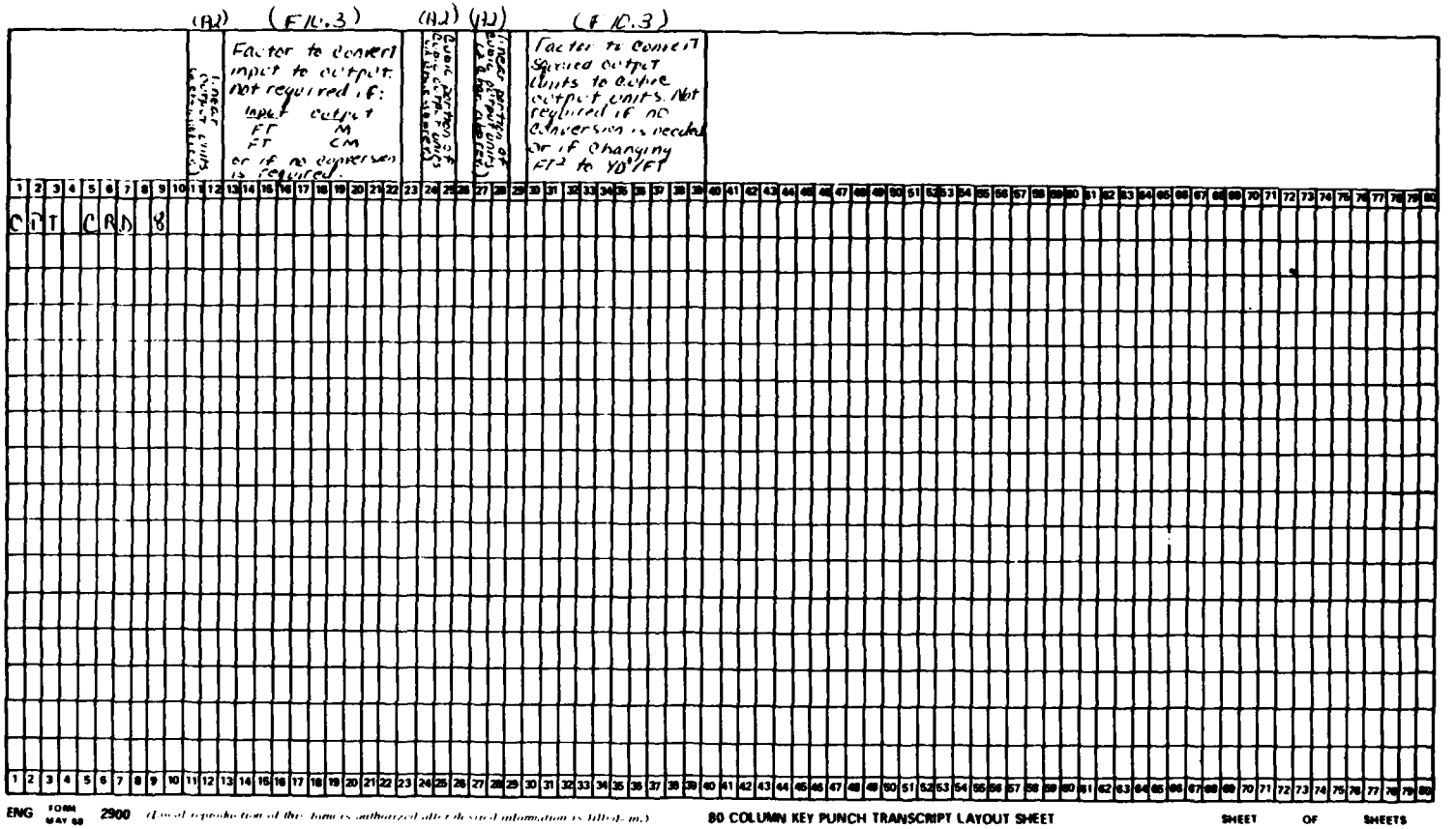
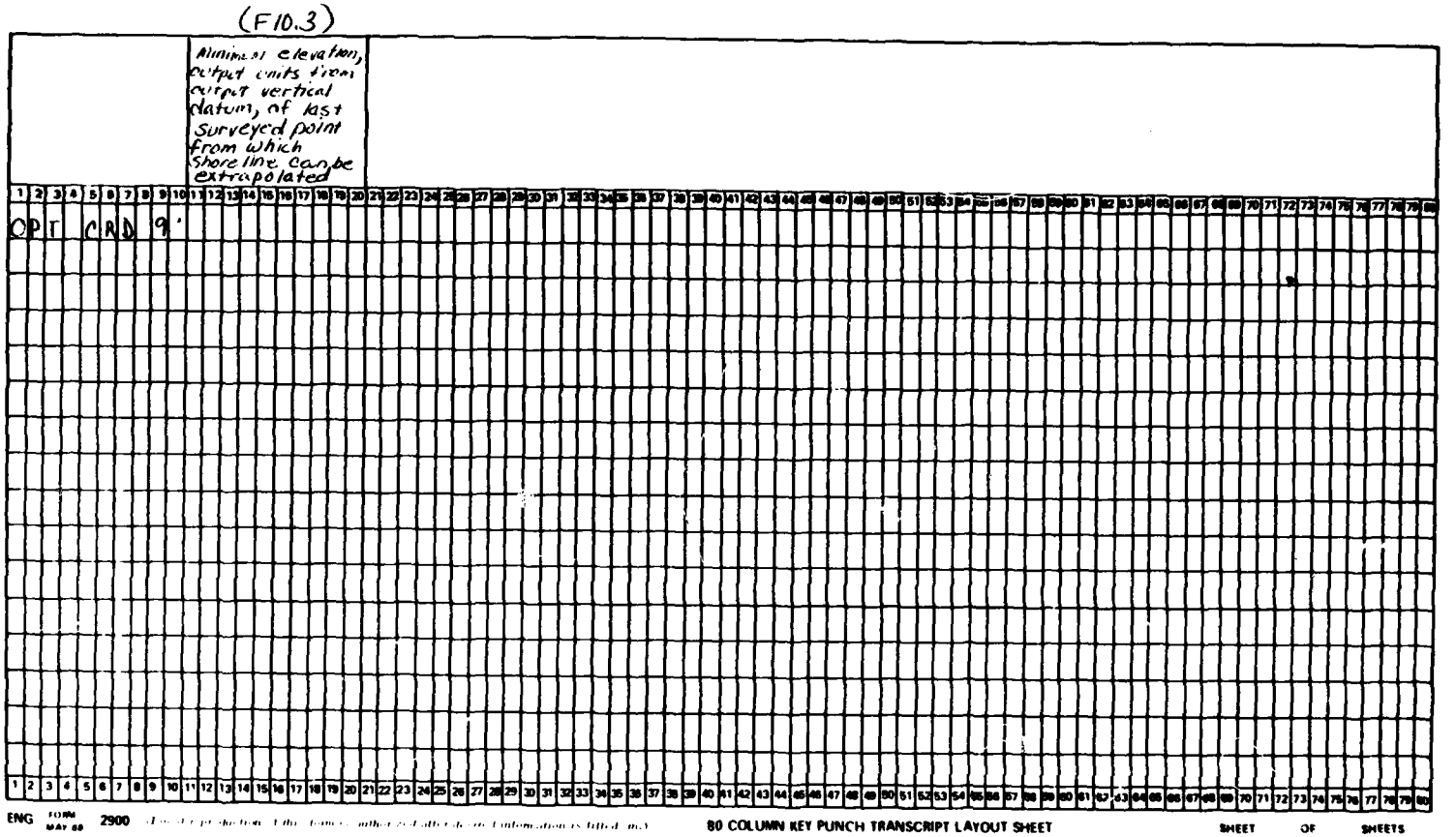
Option Card 8
(only positions 1 to 22 are used by ELVDIS)



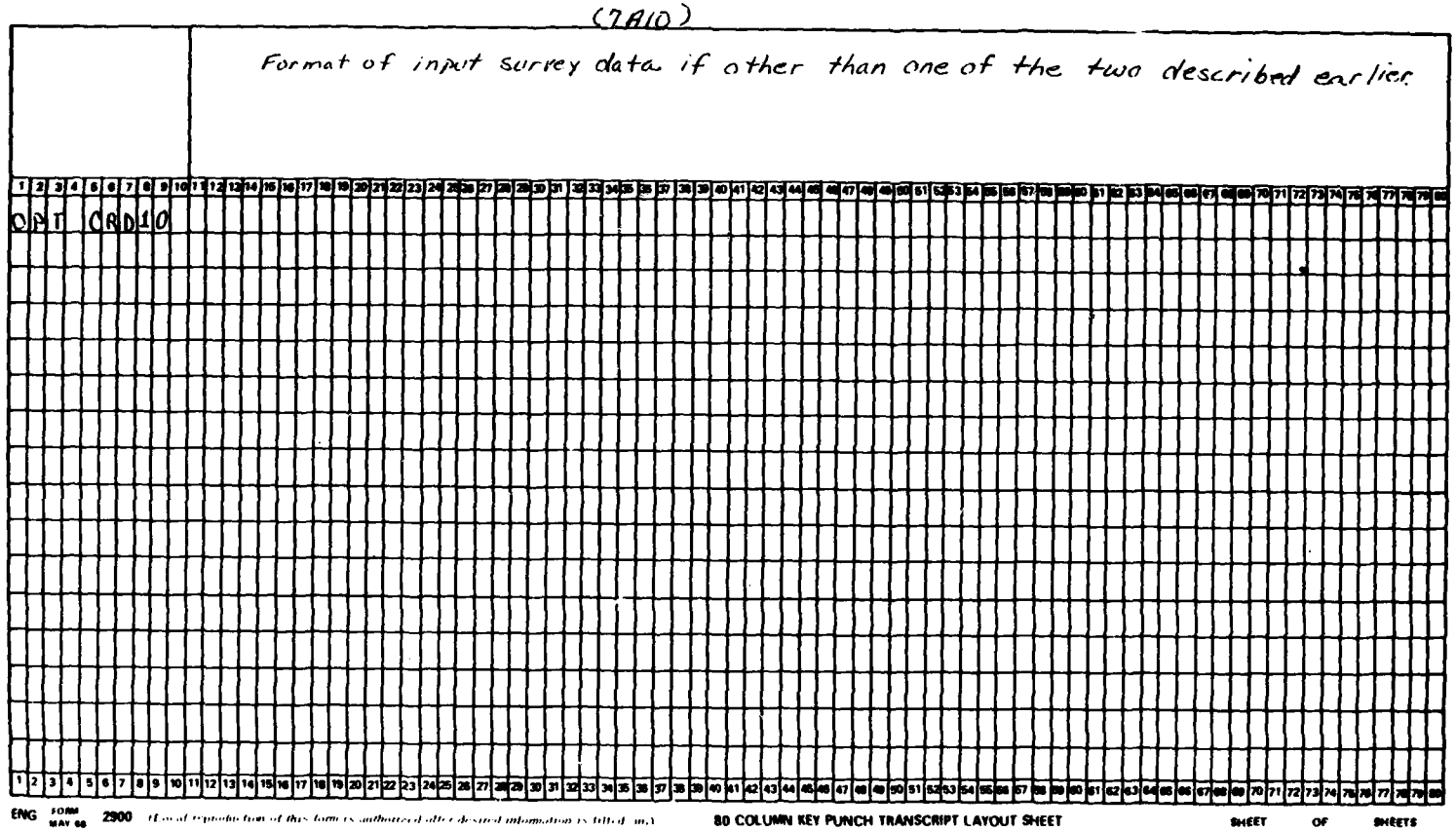
Option Card 9



Option Card 10

(7A10)

Format of input survey data if other than one of the two described earlier



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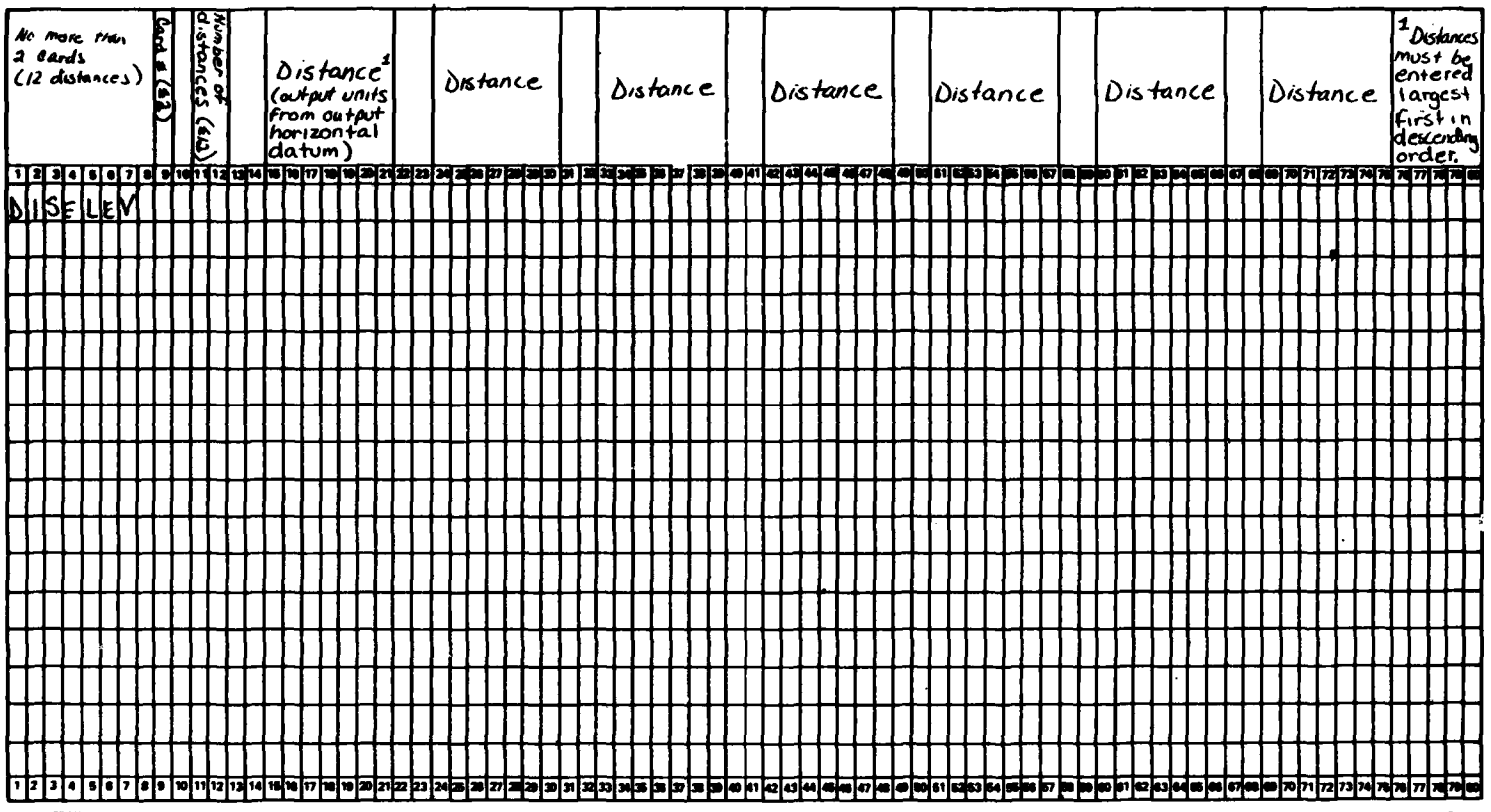
DISELEV Specification Card



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ENVLOP Specification Card

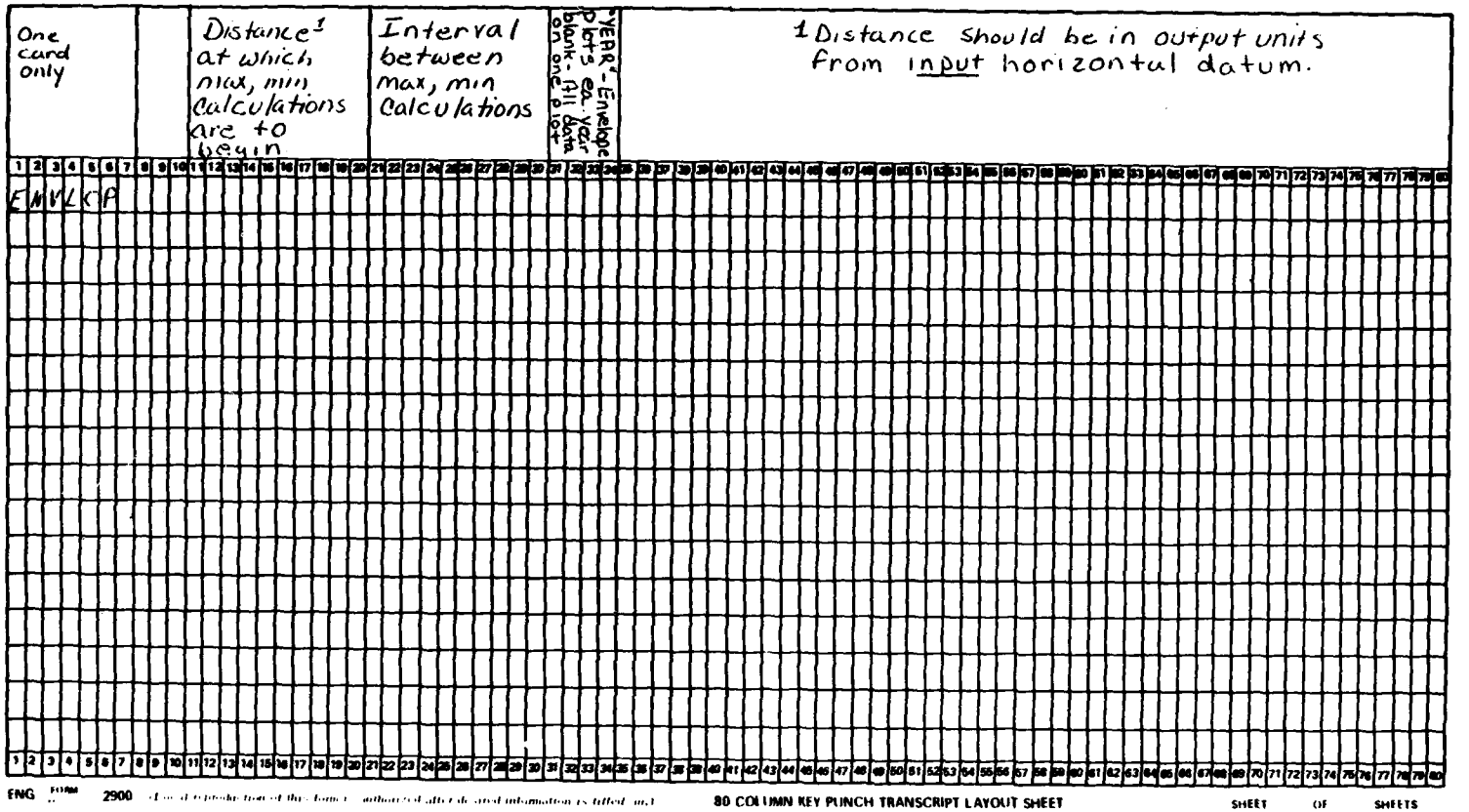


TABLE18 Output Specification Card

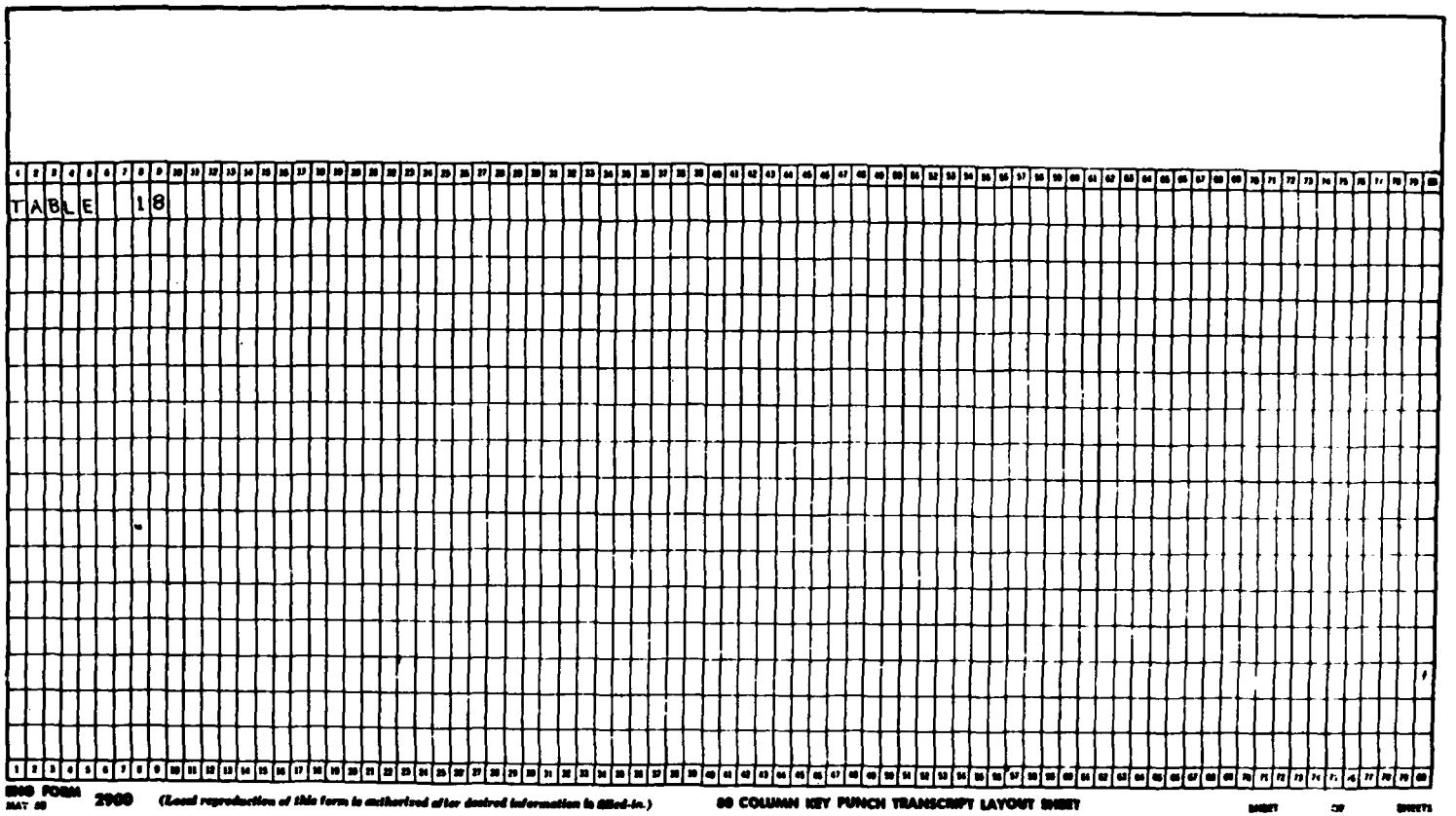
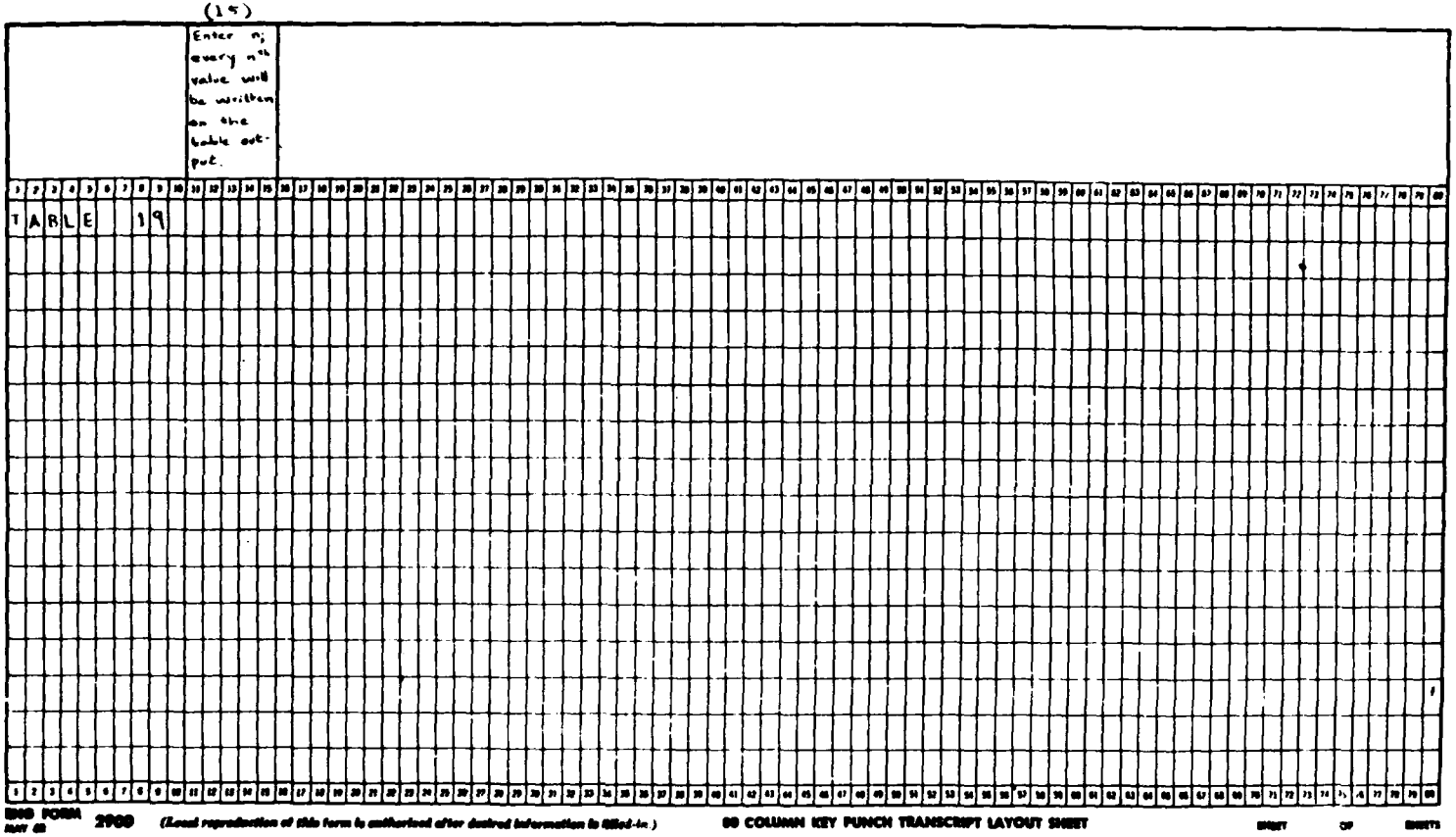


TABLE19 Output Specification Card



PLOT19 Output Specification Card

Columns	Format	Field
1–10		One card only
11	(I1)	3→Plot commands on cards; 8→Tape
12	(I1)	1→Col 13-80 will be completed
13–24	(12I1)	0→Plot distance #, 1→don't (one column for each of 12 distances)
25	(A1)	Type of time, H, D, M, or Y
26–32	(F7.2)	Horizontal (x) Axis – Origin
33–38	(F6.1)	Horizontal (x) Axis – Increment
39–42	(F4.1)	Horizontal (x) Axis – Length
43–50	(F8.2)	Vertical (y) Axis – Origin
51–57	(F7.2)	Vertical (y) Axis – Increment
58–61	(F4.1)	Vertical (y) Axis – Length
62–75		Type of time on horizontal axis: H→Hours, D→Days, M→Months (new plot each year), Y→Years.
76	(I1)	1→Plot will be factored

Sample card entry: PLOT (columns 1–4), 19 (columns 8–9)

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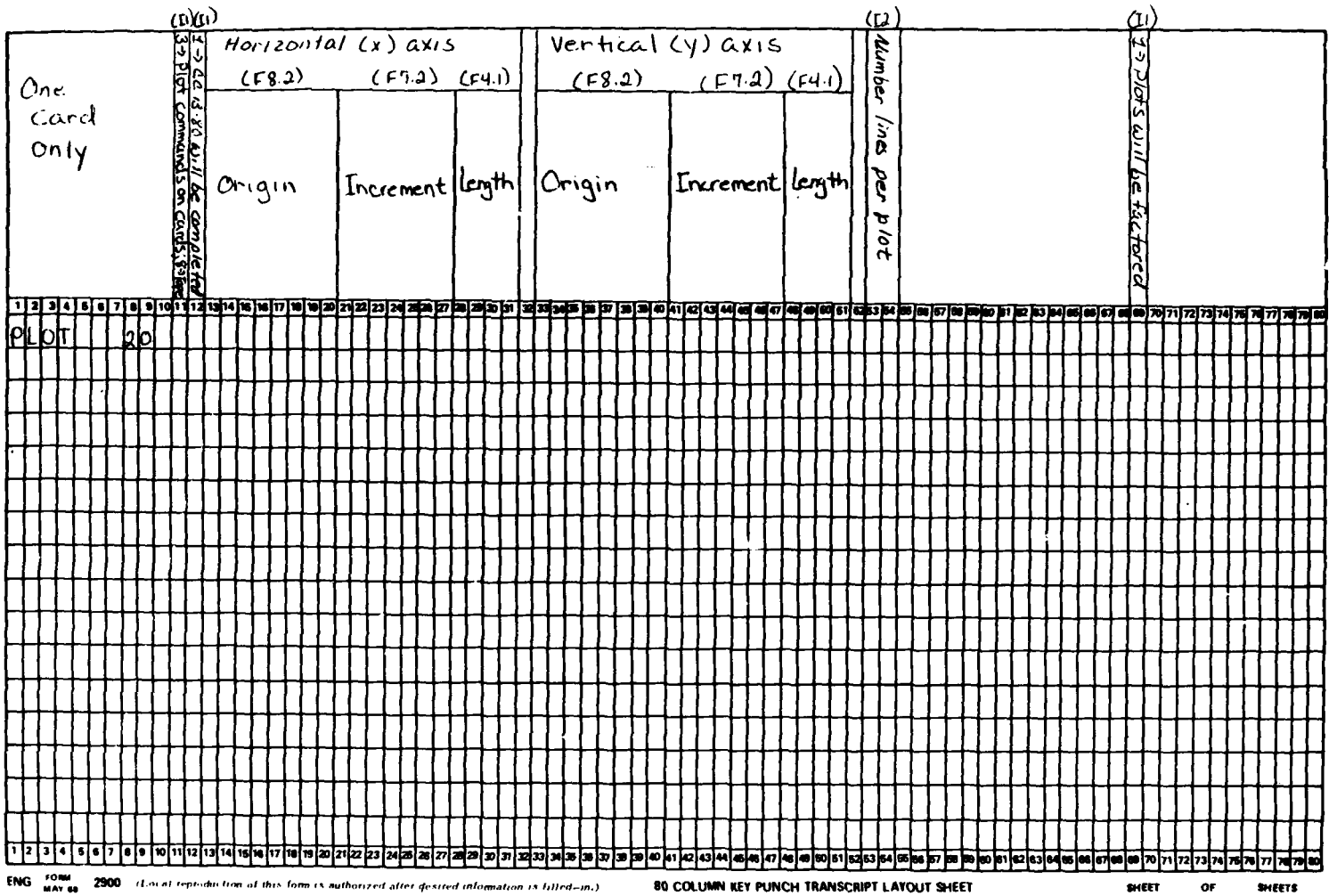
PLOT20 Output Specification Card



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Fleming, Marilyn V.
Beach Profile Analysis System (BPAS). Volume VII. BPAS user's guide: analysis module ELVDIS / by Marilyn V. Fleming, Timothy J. Lawler, and Diane French.--Fort Belvoir, Va. : U.S. Army, Corps of Engineers, Coastal Engineering Research Center ; Springfield, Va. : available from NTIS, 1982.
[52] p. ill. ; 27 cm.--(Technical report / Coastal Engineering Research Center; no. 82-1 v.(VII)). Cover title.
An eight-volume package of computer programs for editing, analyzing, and displaying beach profile survey data is presented consisting of an overview of the Beach Profile Analysis System, two editing programs, five analysis programs, and supporting appendixes. The primary design is for use on the CDC 6600 computer, although much of the coding was done in standard FORTRAN for use on other systems.
1. Data processing. 2. Beach Profile Analysis System. 3. Beach profile changes. 4. Computer programs. I. Lawler, Timothy J. II. French, Diane. III. Title. IV. Series: Technical report (Coastal Engineering Research Center (U.S.)); no. 82-1, v.VII.
TC203 .U581tr no. 82-1, v.VII 627

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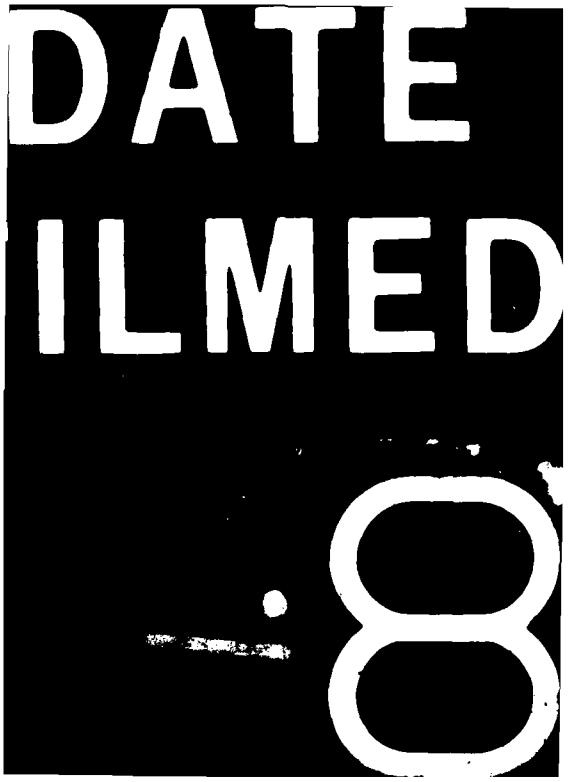
DATE
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8